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ABSTRACT

The gypsy moth is probably the most sociologically if not biologically important insect pest of hardwoods (especially oak). Many people cannot recognize the insect. In addition, they do not understand how much damage it can do, how to control it, or how to stop it from invading new areas. This booklet provides teachers, parents, and leaders of youth groups with ideas and activities that can be used to educate children about this important insect. The 25 activities consist of games, puzzles, and projects, each coded by a recommended age group (ages 4 to 8, 9 to 12, or 13 and over). Objectives, instructional strategies, and list of materials needed are provided for the activities. Activities are designed to increase students' reading comprehension, writing, spelling, and mathematics skills as well as knowledge about the insect. (BC)

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GYPSY MOTH Workbook

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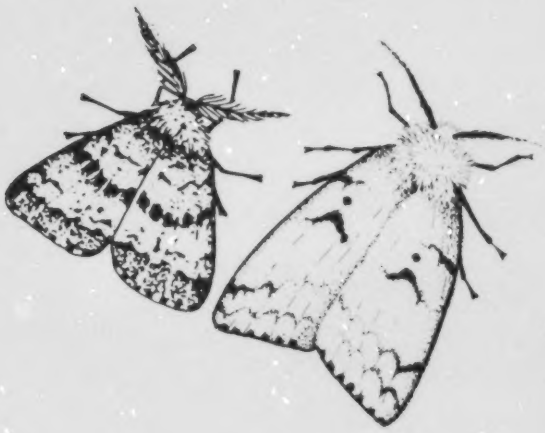
GYPSY MOTH



Workbook

BY DENNIS R. HAMEL

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To
Anthony
and
all his friends
across
America

Acknowledgments

This workbook was completed through the thoughtful cooperation of many people in the American Forestry Association (AFA) and the USDA Forest Service. Deborah Gangloff contributed immensely to style and format; Rudy Wendelin immortalized Spunky and added a touch of humor; Jim Fisher served as Art Director for the workbook. The efforts of these individuals are greatly appreciated. For support, I am indebted to Bob, Esther, Dave, and Norma. For editorial review, I am grateful to Bill Rooney and Gary Moll of AFA; and Jim Stewart and the Forest Pest Management staff. Heartfelt appreciation is also extended to the people of the conscientious and competent clerical staffs of the Forest Service and AFA. Without everyone's help this dream could never have come true.

D.R.H.
1983

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TEACHER

PREFACE

The gypsy moth is probably the most important (sociologically, if not biologically) insect pest of hardwoods—especially oak—in the Eastern United States. A great deal of effort and money have been spent to control or eliminate it from this continent. Yet, it continues to spread and threaten susceptible host tree species nationwide.

Many people can't recognize the insect. They don't understand how much damage it can do, or how to control it, or how to stop it from invading new areas.

This booklet provides teachers, parents, and youth group leaders with ideas and activities that can be used to educate children about this important insect. It contains 25 games, quizzes, puzzles, and projects, each coded by age groups as follows:

= Ages 4–8

= Ages 9–12

= Ages 13 and over

The 25 projects will also serve to increase students' reading comprehension, writing and spelling skills, and math skills.

A glossary (Appendix B) is included in this volume for your convenience.

NOTE: An extensive study on the gypsy moth was published in 1981 as a result of an Expanded Gypsy Moth Research and Development Program sponsored by the U.S. Department of Agriculture. If you would like more detailed scientific information, consult:

The Gypsy-Moth: Research Toward Integrated Pest Management, edited by Charles C. Doane and Michael L. McManus, USDA Tech. Bul. 1584, Washington, D.C., 1981.

Hi,

I've got some fun games to help you learn more about an important insect, the gypsy moth. This book contains outdoor activities, nature hunts, puzzles, quizzes, and a skit and a song. All of these games will help you to learn about the gypsy moth. You will also learn about other things in nature—trees, animals, and people.

Gypsy moth caterpillars can eat all the leaves off a tree in a surprisingly short time. Besides hurting the tree, the gypsy moth eats the leaves I need to build my nest.

As a squirrel, I worry a lot about our trees, and you should, too. Trees provide many products such as lumber for houses and furniture, paper, and food (nuts, fruit and syrup). And although gypsy moth caterpillars provide food for some animals, including squirrels, too many caterpillars do much more damage than good.

I know you will enjoy doing the projects and coloring the pictures in this book, especially the ones of me. Have fun!

Your friend,

Spunky

MEET THE GYPSY MOTH

INTRODUCTION: If you walk in a forest in the spring in the northeastern part of the United States, you will probably hear gypsy moth caterpillars munching away. The scientific name of the gypsy moth is *Lymantria dispar.* The insect is a serious enemy of hardwood forests. It is native to Europe, Asia, and North Africa, but was brought into the United States in 1869 by a French scientist working at Medford, Massachusetts. He wanted to breed the gypsy moth with other moths and create a new race of silk-producing caterpillars or silk-worms. This experiment was not successful, and eventually some of his caterpillars escaped. Ever since, the Northeastern United States has been trying to halt the spread of the moth, whose caterpillar has a huge appetite—especially for oaks but also for about 500 other kinds of trees and shrubs.

EGG MASSES: Gypsy moth eggs are laid in the fall, with 100–1,000 eggs in each cluster. The female covers the clusters with velvety, buff-colored hairs from her body. (The hairs from the egg clusters can cause human skin rashes.)

EARLY INSTAR LARVAE: Gypsy moth caterpillars hatch in April and May. Caterpillars are the larval stage of the gypsy moth. As they grow, the caterpillars go through several stages called instars. In the early instars, the larvae are black and have long hairs along their sides. (These hairs can also cause human skin rashes.) Young larvae climb into trees and hang from branches on silken threads. The threads and attached larvae are often caught by the wind and carried off. This results in further spread of the gypsy moth.

LATE INSTAR LARVAE: Male gypsy moth larvae go through five instars; females go through six. The larvae grow larger during each instar. As they grow, they shed their old skin and replace it with a larger, more colorful one. Older larvae are grey-black with two rows of colored spots along their back. The first five pairs of spots are blue; the last six pairs are red.

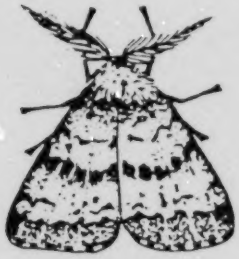
PUPAE: When late-instar larvae finish feeding in early summer, they shed their skins once more and become pupae. During this time they no longer eat or move about. Each pupa is reddish brown and may be attached by several silk threads to tree trunks, rocks, or boards.

ADULTS: The pupal stage does not last long. Adult moths hatch about mid-June or July. A male moth is tan to dark brown with black, wavy lines on his wings. He is a strong flier. A female moth is nearly white with brown spots and lines on her wings. She cannot fly. She must wait for the male to find her in order to mate.

MEET THE GYPSY MOTH

STUDENT

I am a female gypsy moth. My wings are white. They have brown, wavy marks. I live in the summer. I have wings, but I cannot fly. I am bigger than a male gypsy moth.



I am a male gypsy moth. My wings are brown with black, wavy markings. My "feelers" (antennae) are yellow. I also live in the summer. I fly during the day in search of females.

I am a gypsy moth pupa. My outer skin is red-brown. I am a resting stage. I was a caterpillar. I will be a moth.

I am a gypsy moth caterpillar. My fuzzy hairs are black. When I am small, I am mostly black, but as I get older, I have five pairs of blue spots and six pairs of red spots on my back. My favorite food is oak leaves. I eat and crawl in the spring. When I am really hungry, I can eat many leaves each day.

I am a gypsy moth egg mass. There are 100 to 1,000 eggs under my cream-colored covering. I can be found from early fall through winter. In the spring, young caterpillars will hatch from me.

TEACHER PROJECT

1

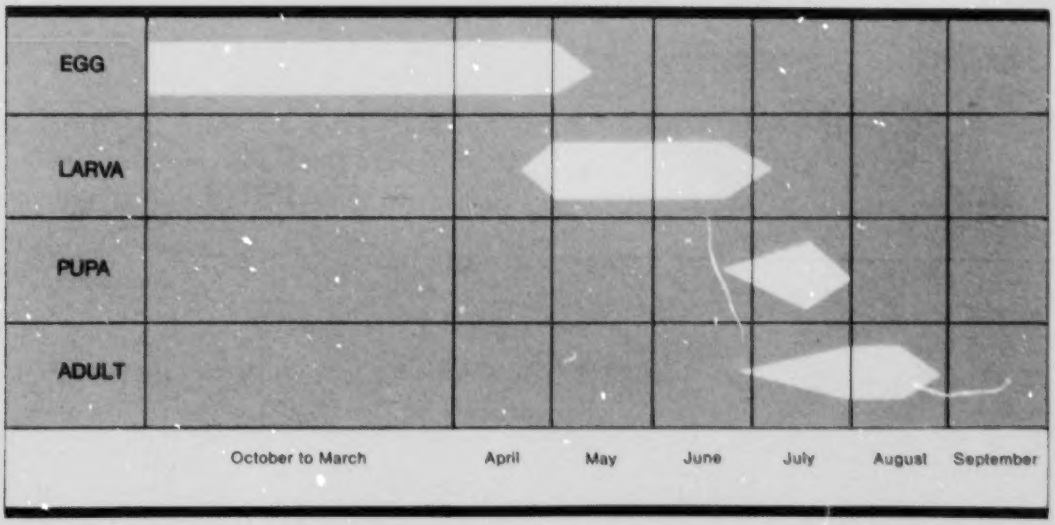
Age Class

GYPSY MOTH LIFE CYCLE

OBJECTIVE: To recognize gypsy moth life stages and learn when they occur.

INSTRUCTIONS: Discuss the life-stage descriptions in the Introduction with students and encourage them to color the pictures on their page. It is important that they be able to recognize gypsy moth larvae by their distinctive five pairs of blue spots fore and six pairs of red spots aft. Remind students that the larger adult moth is the female, which is basically white and brown, and the smaller adult moth is the male, which is brown and black.

For older students, use the following time scale to show when eggs, caterpillars, pupae, and adults can be found.



Actual time and length of stages depend on specific locality, weather, and amount of food available.

GYPSY MOTH LIFE CYCLE

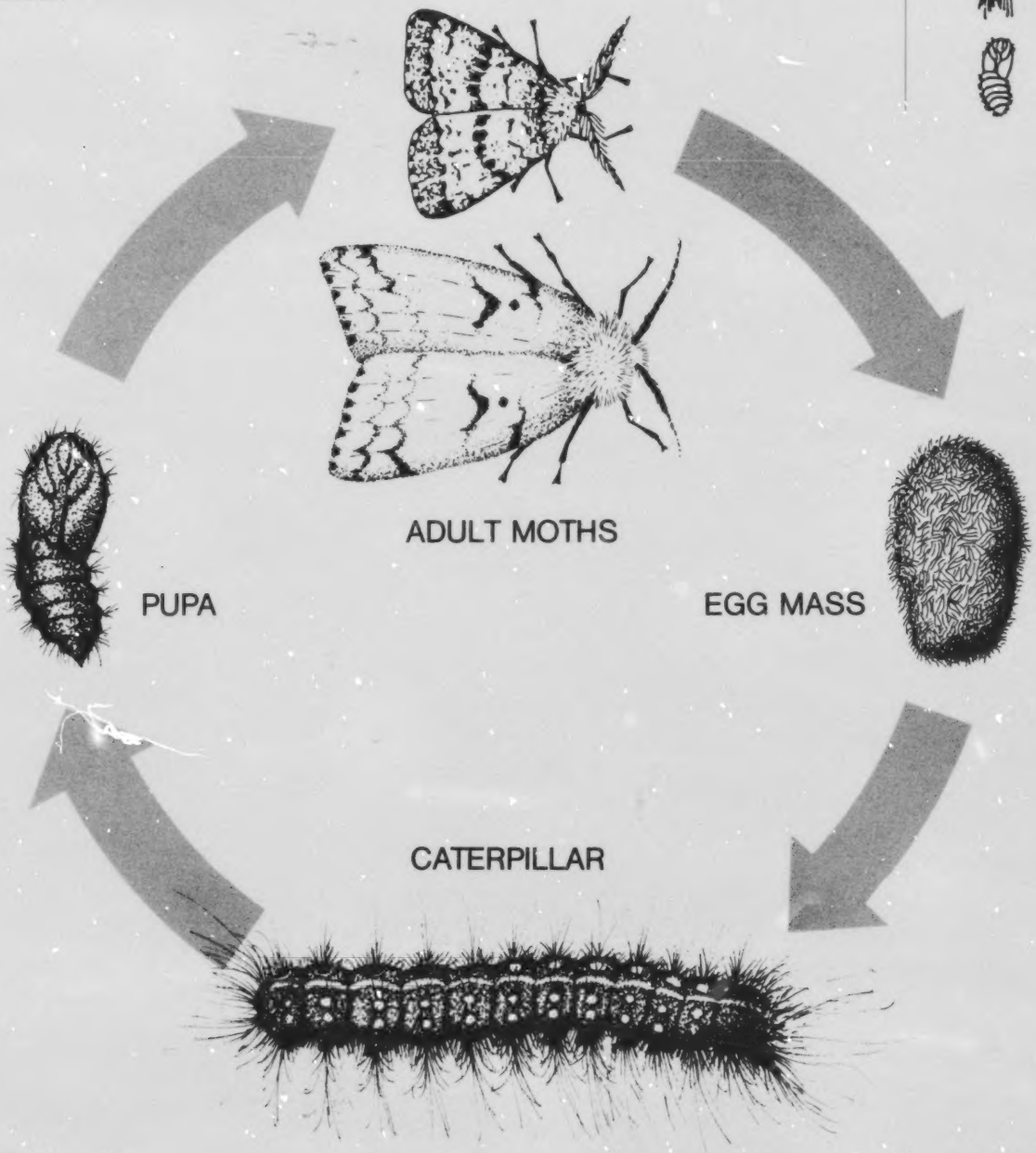
STUDENT PROJECT 1

Age Class

INTRODUCTION: Have your teacher explain how the gypsy moth came to our country and why it is important to us.

MATERIALS NEEDED: Colored pencils, pens, or crayons.

INSTRUCTIONS: Read about the life stages of the gypsy moth in the Introduction. Color the egg mass, caterpillar, pupa, and gypsy moth adults from the description on page 5. You may also want to label the arrows according to time of year when these life stages occur.



TEACHER

PROJECT

2

Age Class

VALUES AND PRODUCTS OF TREES

OBJECTIVE: To recognize and appreciate the value of trees and understand the effects of the gypsy moth.

INSTRUCTIONS: Every day we rely on trees for a variety of products: homes, furniture, packaging materials, paper, food (nuts, fruits, syrup, etc.), lumber, plywood, and thousands of other items. Many of us live and work in homes, offices, and schools constructed primarily of wood. In addition, trees are valued for esthethics, recreation, wildlife habitat, and control of noise and air pollution.

Students will better understand the extent to which we depend on trees and the impact of the gypsy moth by participating in this game project.

Encourage students to list as many things as they can that are provided by trees. Then at the end of the information-listing period, you can play the following game. Have all participants stand with their completed game sheets in hand. Teachers should make up their own lists to reflect the interests and educational level of their participants. Explain that you will call out, one at a time, common products and values of trees. At each calling, participants should check their sheets. If they have the item listed, they remain standing. If they do not have the item, they sit down. Progress from very common items to more difficult ones. The object of the game is for each participant to remain standing as long as possible. The last standing person is declared the winner.

After the initial part of the game, participants are encouraged to discuss how each of the items they have listed could be affected by an infestation of gypsy moths. Remember that not everything would be impacted negatively (e.g., birds and other animals which feed on gypsy moth larvae benefit from increased food supplies). Two lists should result: one for negative impacts from the gypsy moth, the other for positive impacts.

VALUES AND PRODUCTS OF TREES

STUDENT PROJECT 2

Age Class

INTRODUCTION: Trees provide many, many things, including the pencil and paper you will need to win this game.

MATERIALS NEEDED: Pencil and paper.

INSTRUCTIONS: Follow the game instructions provided by your teacher/leader. List as many things as you can that are provided by trees. Remember that every day we rely on trees to provide many things. For example, do you remember that trees provide homes for wild animals, lumber for our homes, things for us to eat (for example, fruits, nuts, and syrup), and paper to write on? How many more things can you list that we get from trees? See if you can have the longest list of items, and then be prepared to discuss how each of them would be affected by an infestation of gypsy moths. Remember that some things, like birds, benefit from an increased supply of gypsy moth caterpillars, while the trees themselves can be severely damaged by the gypsy moth's leaf-eating activities.

TEACHER

PROJECT

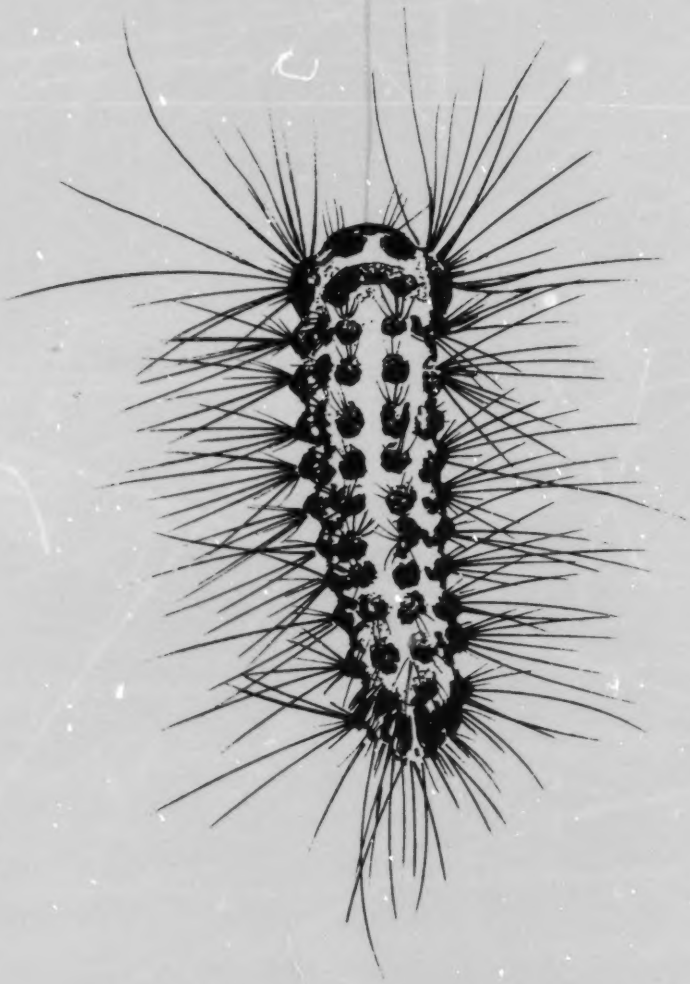
3

Age Class

LOST LARVA

OBJECTIVE: To recognize one way in which the gypsy moth spreads.

INTRODUCTION: Explain that gypsy moth larvae have a habit of spinning down on silken threads. Winds then blow them to different locations. Frequently, larvae are blown away from their host trees. This is when natural predators such as mice, beetles, and birds often catch and eat them.



LOST LARVA

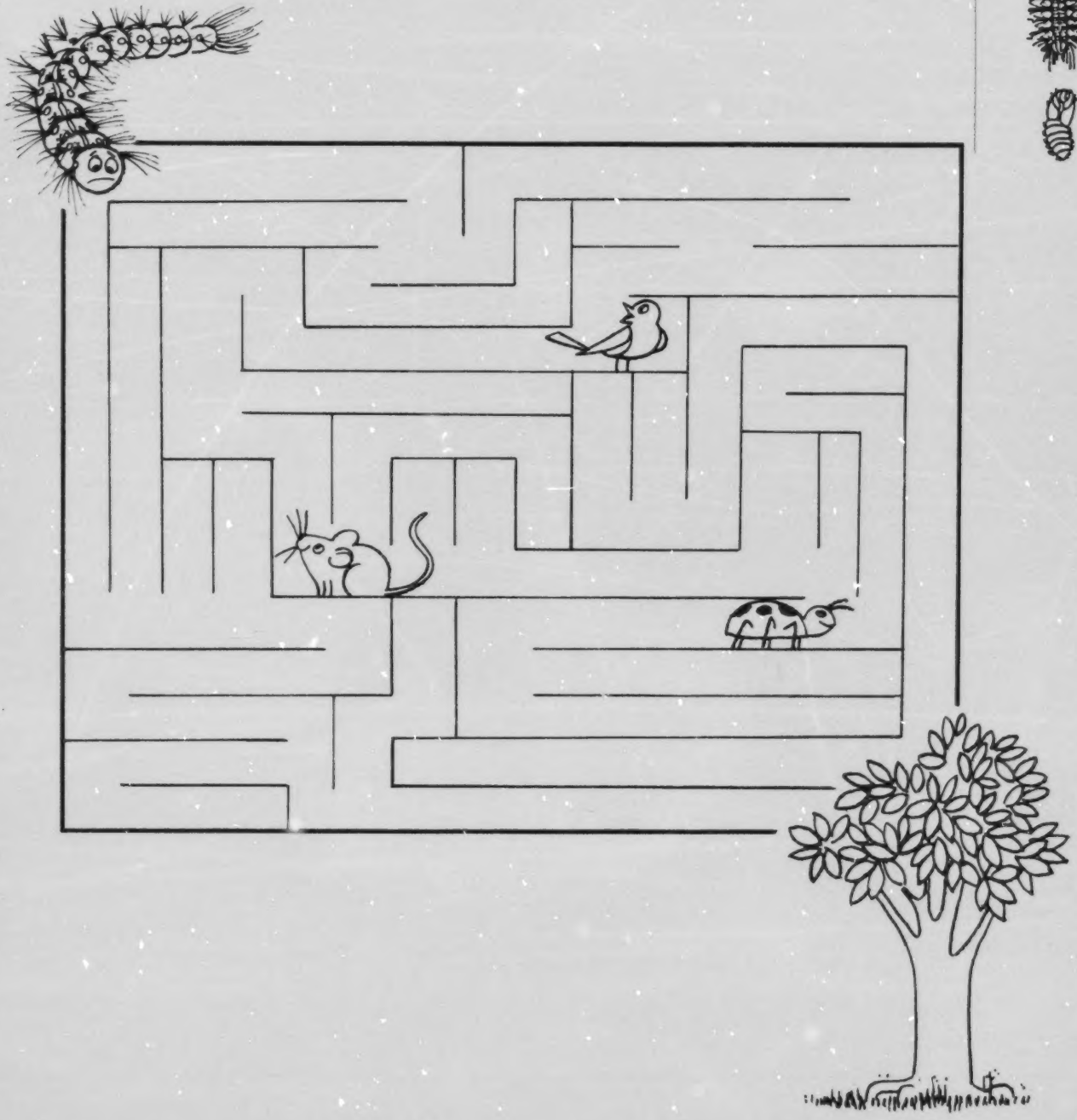
STUDENT PROJECT 3

Age Class

INTRODUCTION: Can you help the lost larva escape its enemies and find its way back into the tree?

MATERIALS NEEDED: Pencil.

INSTRUCTIONS: Follow the correct path for the larva to get back to its tree without being eaten by the bird, mouse, or beetle.



TEACHER PROJECT

4

Age Class

QUIZ BOXES

OBJECTIVE: To develop spelling skills, especially of words associated with the gypsy moth's life history.

INSTRUCTIONS: Explain that for each completed 3 × 3 box, the answers read the same across and down. Answers are on page 77.

QUIZ BOXES

STUDENT PROJECT

4

Age Class

INTRODUCTION: Word quizzes are fun and help us learn. Try these. Your answers should read the same across and down. The pictures on the opposite page are clues that you can color.

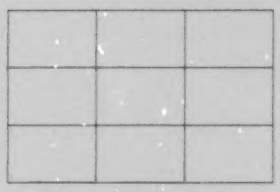
MATERIALS NEEDED: Pencil.

INSTRUCTIONS: Write the three-letter answer to each question in the squares to the right of the clues. Do your answers read the same across and down? Check your answers with your teacher/leader.

A. 1. Favorite gypsy moth tree?

2. Another name for monkey?

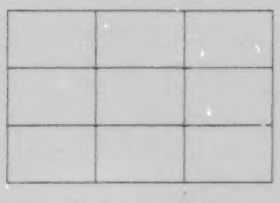
3. Tool for opening a lock?



B. 1. Insect that feeds at flowers?

2. First gypsy moth life stage?

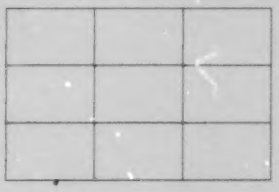
3. Another word for self?



C. 1. Another name for an insect?

2. A Utah Indian?

3. Precious stone?



D. 1. Obey the ___?

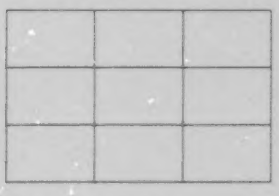
2. Another name for chimpanzee?

3. A spider's gypsy moth trap?

E. 1. What we breathe?

2. Another word for madness?

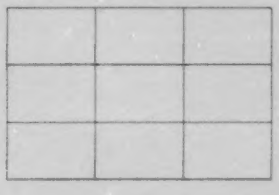
3. Color of larval gypsy moth spots?



F. 1. A gypsy moth parasite?

2. Name of a Southern General?

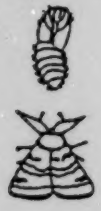
3. An evergreen shrub?



TEACHER PROJECT

5

Age Class



WORD RING

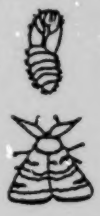
OBJECTIVE: To develop spelling skills, and learn how to spell words associated with the gypsy moth's life history.

INSTRUCTIONS: Explain that by using the 32 letters in the word ring, students can spell at least 32 words of two or more letters. The letters are to be used in order, moving clockwise around the word ring. Answers on page 77.

WORD RING

STUDENT PROJECT 5

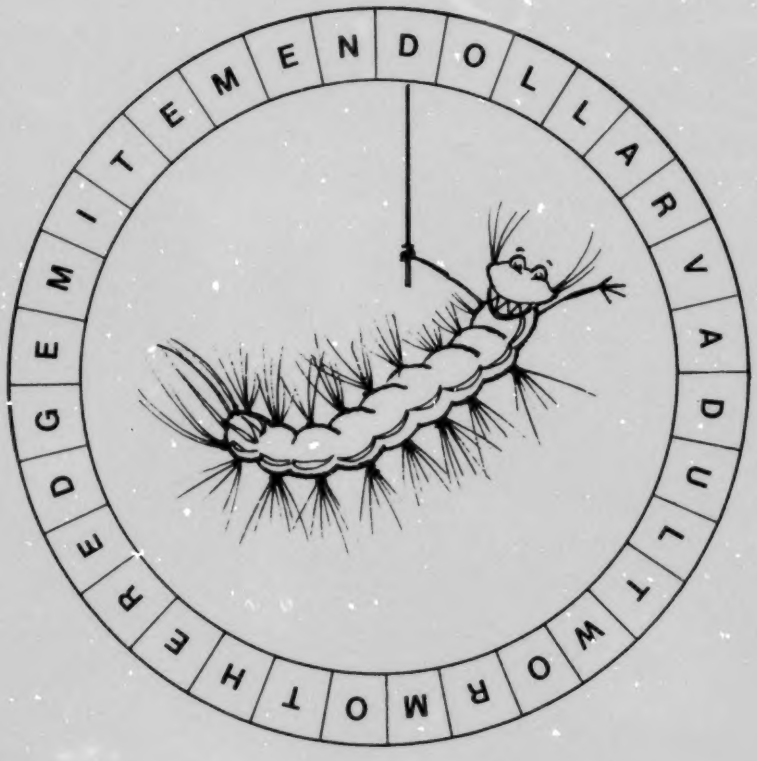
Age Class



INTRODUCTION: Sometimes words have other words within them; for example, the word *female* has three words within it—male, ale, and em. Try this word ring and see how many words you can find.

MATERIALS NEEDED: Pencil.

INSTRUCTIONS: Using the 32 letters in the ring, find 32 words of two or more letters each. Begin at the pointer and move clockwise around the Word Ring. List your words, and don't forget to look for words within words.



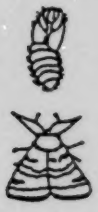
YOUR WORD LIST

TEACHER

PROJECT

6

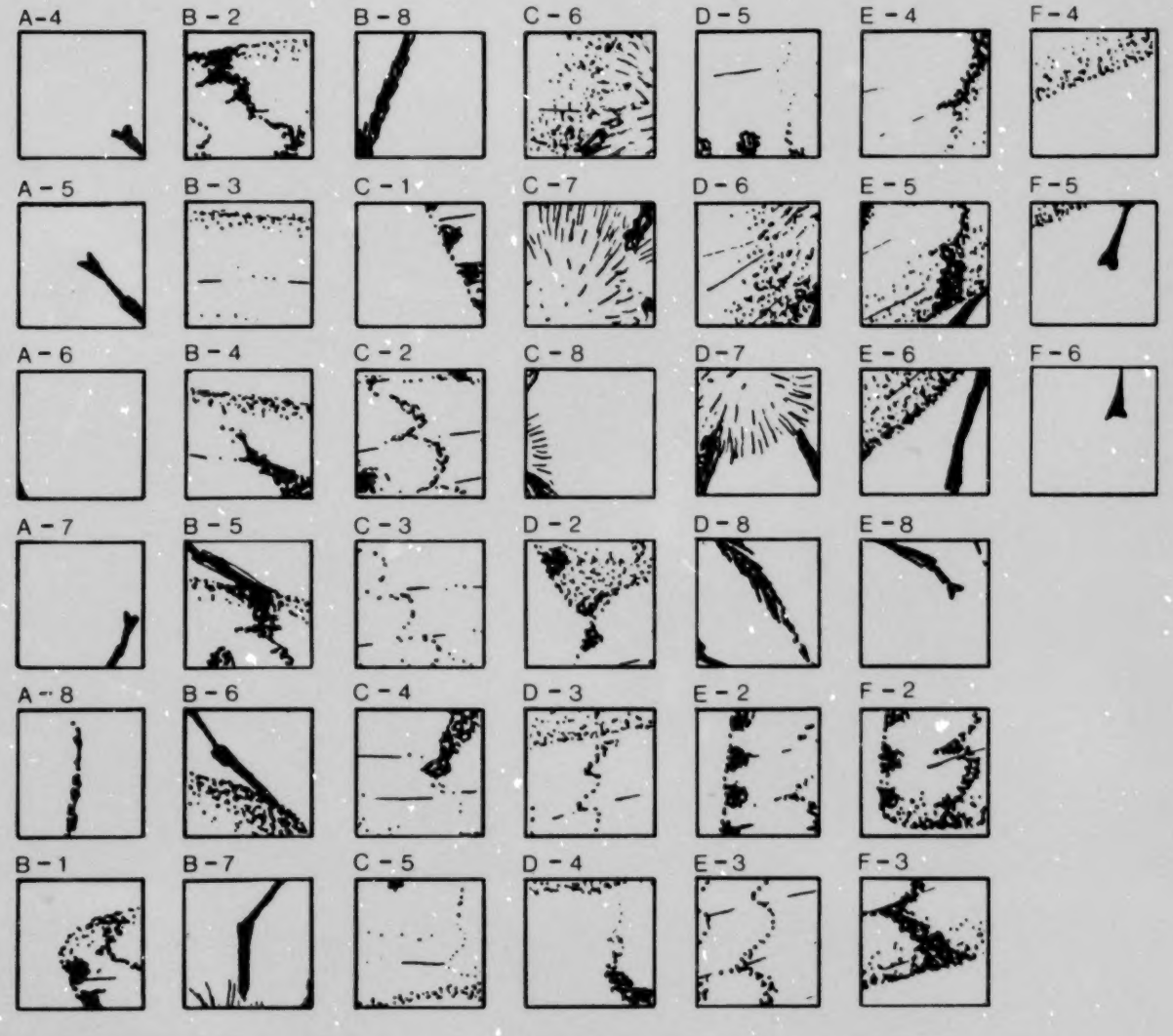
Age Class



PICTURE THIS

OBJECTIVE: To develop eye and hand coordination and artistic skills.

INSTRUCTIONS: Explain to students that they do not need any special training to do this project, but that they will have to be very careful duplicating the correct designs from the boxes on this page in the correct columns and rows on the next page. If the instructions are followed correctly, a picture of an important stage in a gypsy moth's life will result. The answer is on page 77.



PICTURE THIS

STUDENT PROJECT

6

Age Class

INTRODUCTION: You do not need any special training to produce a picture in the square below.

MATERIALS NEEDED: Pencil.

INSTRUCTIONS: Use the letter/number guide above each square on the previous page and carefully draw exactly what you see in the square in the corresponding square in the diagram below. For example, the design in square A7 goes into the square in row A and column 7. Try it. Continue until you have completed all the squares. What did you draw?

	1	2	3	4	5	6	7	8
A								
B								
C								
D								
E								
F								

TEACHER PROJECT

7

Age Class

SPIRAL SPELLING

OBJECTIVE: To develop spelling skills, especially of words associated with the gypsy moth's life history.

INSTRUCTIONS: Explain that by following the clues and spelling correctly, this puzzle can be completed two ways—outward and inward. A student who is stumped in one direction may reverse directions and proceed. Students stumped going in both directions may need your assistance. Answers on page 77.

OUTWARD

1- 3 Morning moisture
3- 6 Caterpillar
6- 9 Gypsy ___
10-12 Tree liquid
13-15 Sculpture
16-20 Copy machine
21-24 Opposite of closed
25-30 Larval life stage
31-36 Blossom
35-38 Great Lake
39-42 Larval food item
43-45 Fifth month
46-49 Uncovered
50-53 Immature beetle
54-57 Jump
57-59 Small dog
60-63 Attract
64-66 Snakelike fish
65-69 Older
70-72 Form of verb "to be"
72-75 Give off
76-80 To contradict

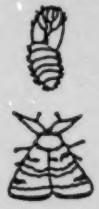
INWARD

80-76 Potato root
75-71 One that times
71-68 Unique
69-67 Color
66-60 Toward windward side
59-55 After larvae
53-48 Ham ___ and fries
45-43 Sweet potato
42-40 Girl's name
39-37 Hawaiian necklace
38-35 Ireland
34-31 Lobo
30-27 Rodents
26-23 No. after 8
22-20 Chicken ___
19-17 Mineral
17-13 More than enough
15-12 Catch
11- 9 Tree
8- 6 Male turkey
5- 1 Oared

SPIRAL SPELLING

STUDENT PROJECT 7

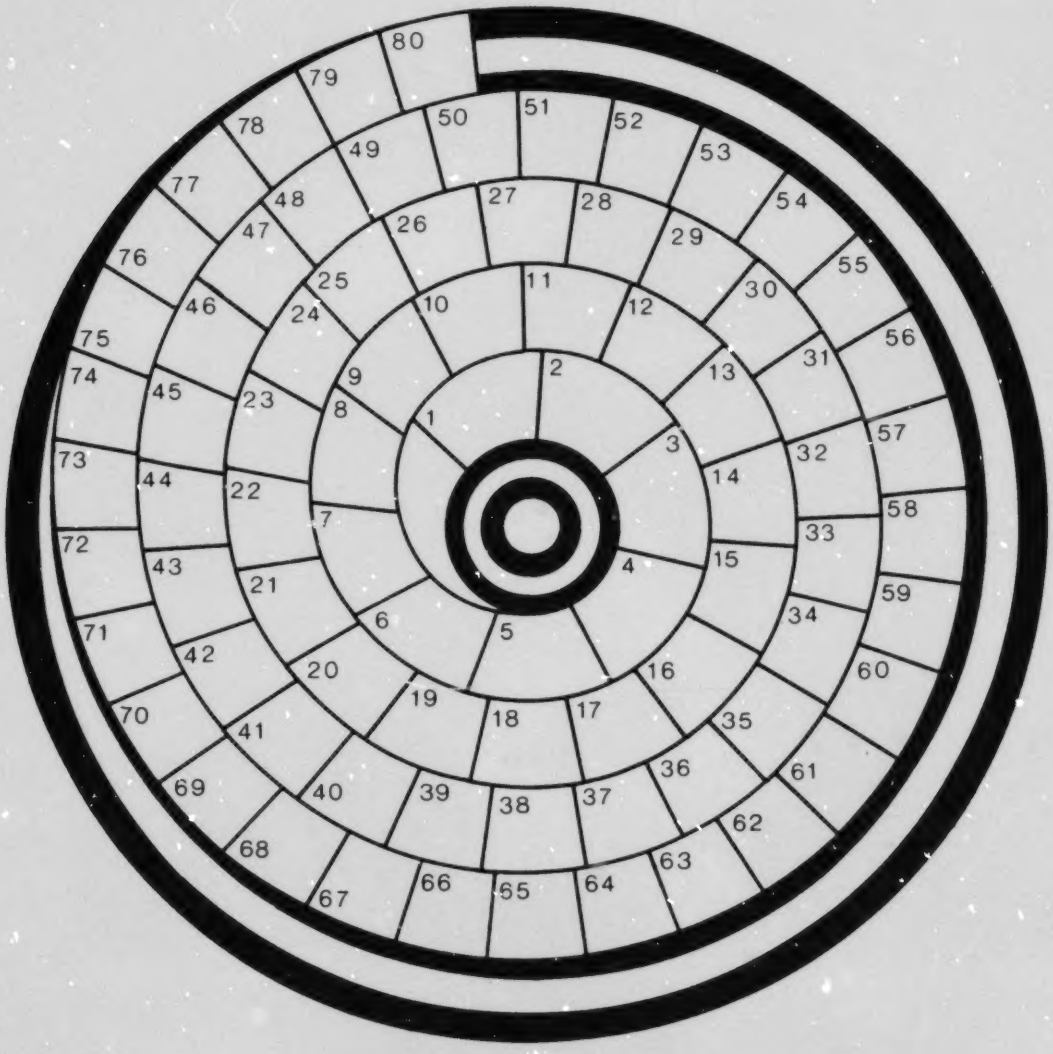
Age Class



INTRODUCTION: See if you can spell in circles.

MATERIALS NEEDED: Pencil.

INSTRUCTIONS: This game works two ways, outward and inward. Use the clues on the opposite page to fill in the spiral. If you are outward bound, guess the word that fits definition 1-3 and put the three letter word in spaces 1-3. Then go on to the definition for 3-6, 6-9, and so on. If you're stuck with an outward bound word, try the inward definitions. Work both ways until you finish.



TEACHER PROJECT

8

Age Class

WORD PYRAMID

OBJECTIVE: To develop spelling and problem-solving skills.

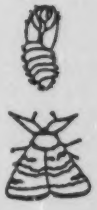
INSTRUCTIONS: The Egyptian pyramids weren't easy to build, and neither is the Word Pyramid. Encourage your students to try it, but be prepared to help. The answers are on page 77.

WORD PYRAMID

STUDENT PROJECT

8

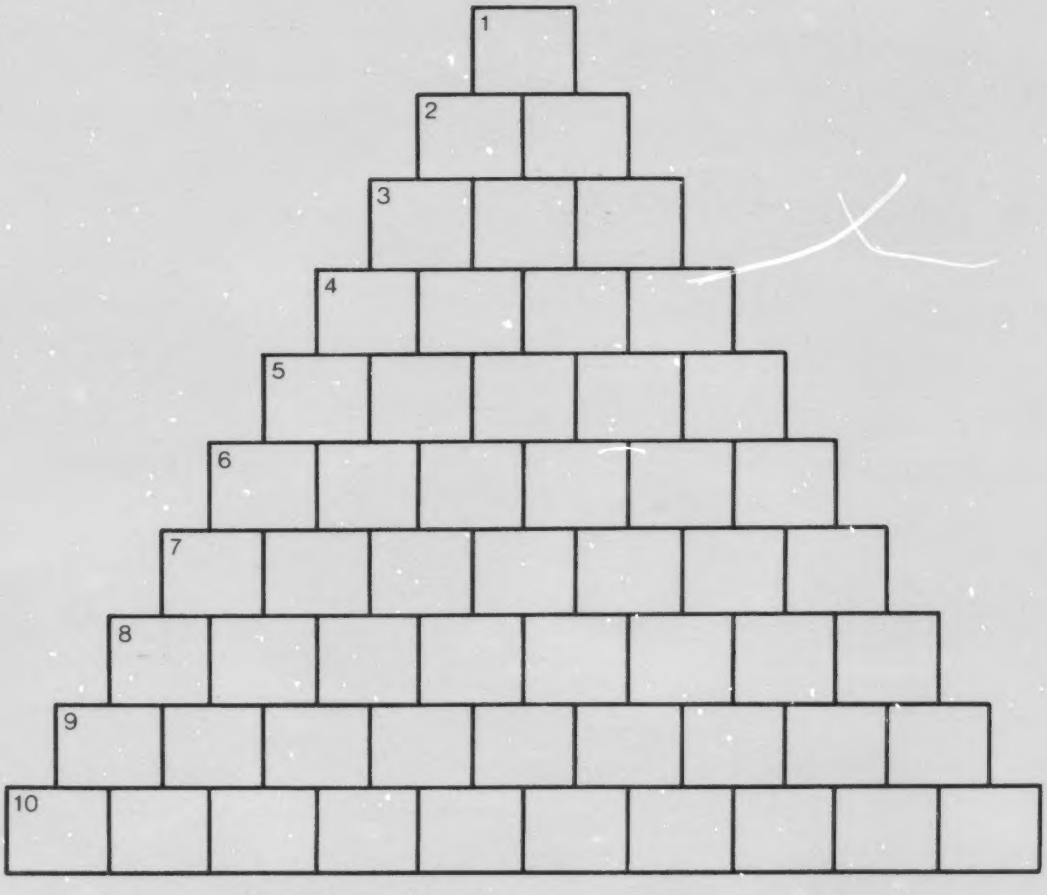
Age Class



INTRODUCTION: Word Pyramids can be created by starting with one letter and adding other letters to it one at a time.

MATERIALS NEEDED: Pencil.

INSTRUCTIONS: Using clues 1-10, create a Word Pyramid. Beginning at the top, write the answers to the clues in the corresponding numbered boxes. Read across only. The answer to each clue contains one new letter plus all the letters in the word above it. Sometimes the letters appear in different order.



1. Ninth letter of alphabet
2. Opposite of out
3. Mineral
4. Fork point
5. Beer mug
6. Bug
7. Messages
8. Divisions
9. Temporary stop
10. Without action

TEACHER PROJECT

9

Age Class

GYPSY GYRATIONS

OBJECTIVE: To develop eye-hand coordination skills and to learn an important scientific concept of insect communication.

INSTRUCTIONS: Remind students that gypsy moth females cannot fly. For mating to occur, the males must find the females. To do this they must follow a scent trail produced by the female. The airborne scent that the male follows is called a pheromone. Subject to minor changes in wind direction, the pheromone trail often becomes convoluted. This results in a characteristic zigzag flight pattern by gypsy moth males searching for females ready to lay eggs.

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GYPSY GYRATIONS

STUDENT PROJECT 9

Age Class

INTRODUCTION: Since female gypsy moths cannot fly, the males must fly to them. They do this by following the scent of the female, which scientists call a pheromone.

MATERIALS NEEDED: Pencil.

INSTRUCTIONS: Follow the scent trails and see which male moth finds the female.

TEACHER PROJECT

10

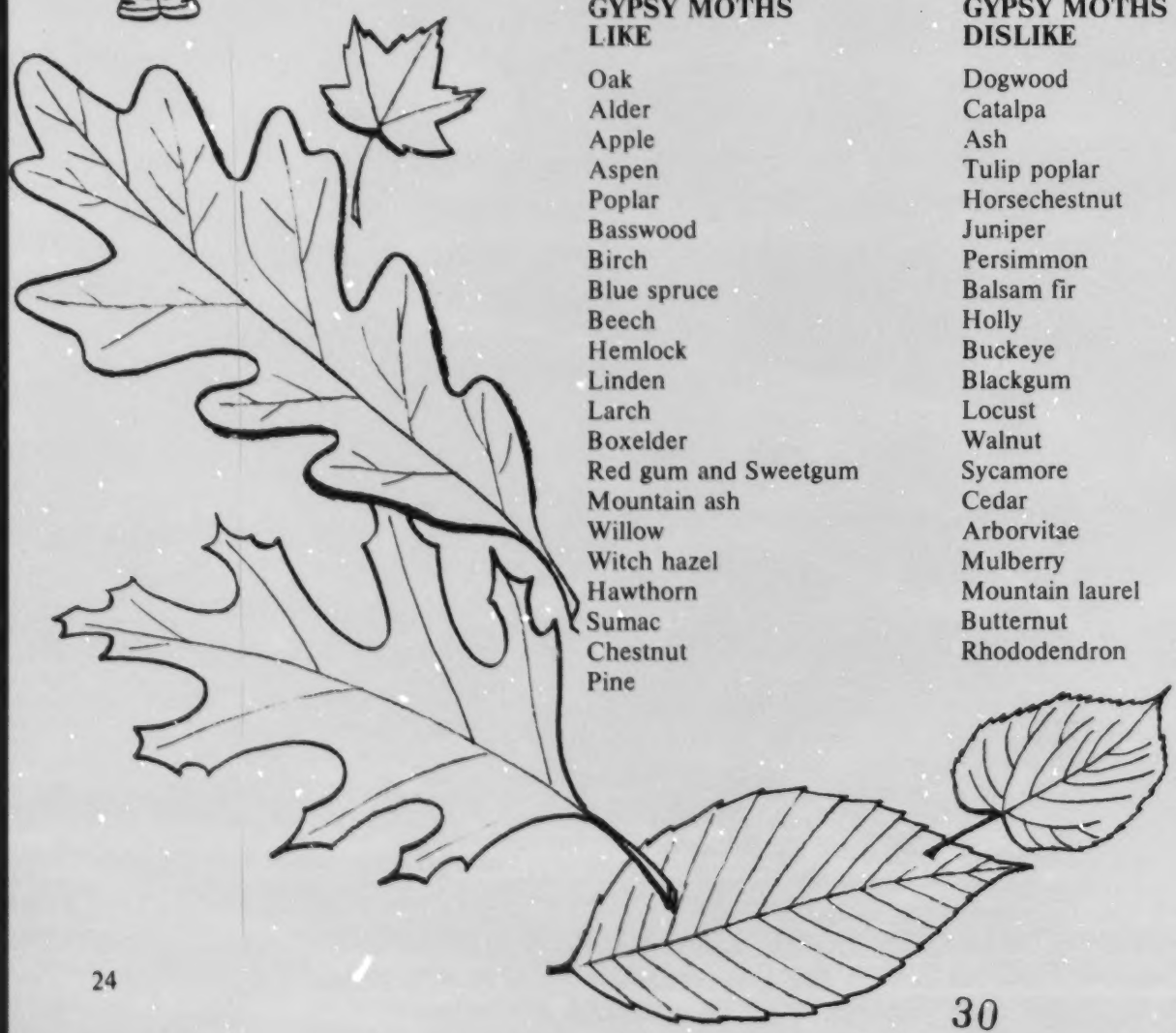
Age Class

PRESSED LEAVES

OBJECTIVE: To develop tree identification skills through proper collection, pressing, and labeling of plant specimens.

INSTRUCTIONS: Knowledge of tree species is important in determining what impact the gypsy moth will have in any particular area. In summer, leaf identification is one of the easiest ways to determine what trees are present in an area. Students can learn about both the gypsy moth and tree identification by observing trees and making a pressed leaf collection. It can be a collection of preferred host trees or both preferred and nonpreferred. Proper pressing, labeling, identification, and preservation are important concepts to be taught during this project. Your assistance with these activities will enhance student learning. The following lists indicate preferred and nonpreferred gypsy moth hosts.

TREE LEAVES GYPSY MOTHS LIKE	TREE LEAVES GYPSY MOTHS DISLIKE
Oak	Dogwood
Alder	Catalpa
Apple	Ash
Aspen	Tulip poplar
Poplar	Horsechestnut
Basswood	Juniper
Birch	Persimmon
Blue spruce	Balsam fir
Beech	Holly
Hemlock	Buckeye
Linden	Blackgum
Larch	Locust
Boxelder	Walnut
Red gum and Sweetgum	Sycamore
Mountain ash	Cedar
Willow	Arborvitae
Witch hazel	Mulberry
Hawthorn	Mountain laurel
Sumac	Butternut
Chestnut	Rhododendron
Pine	



PRESSED LEAVES

STUDENT PROJECT

10

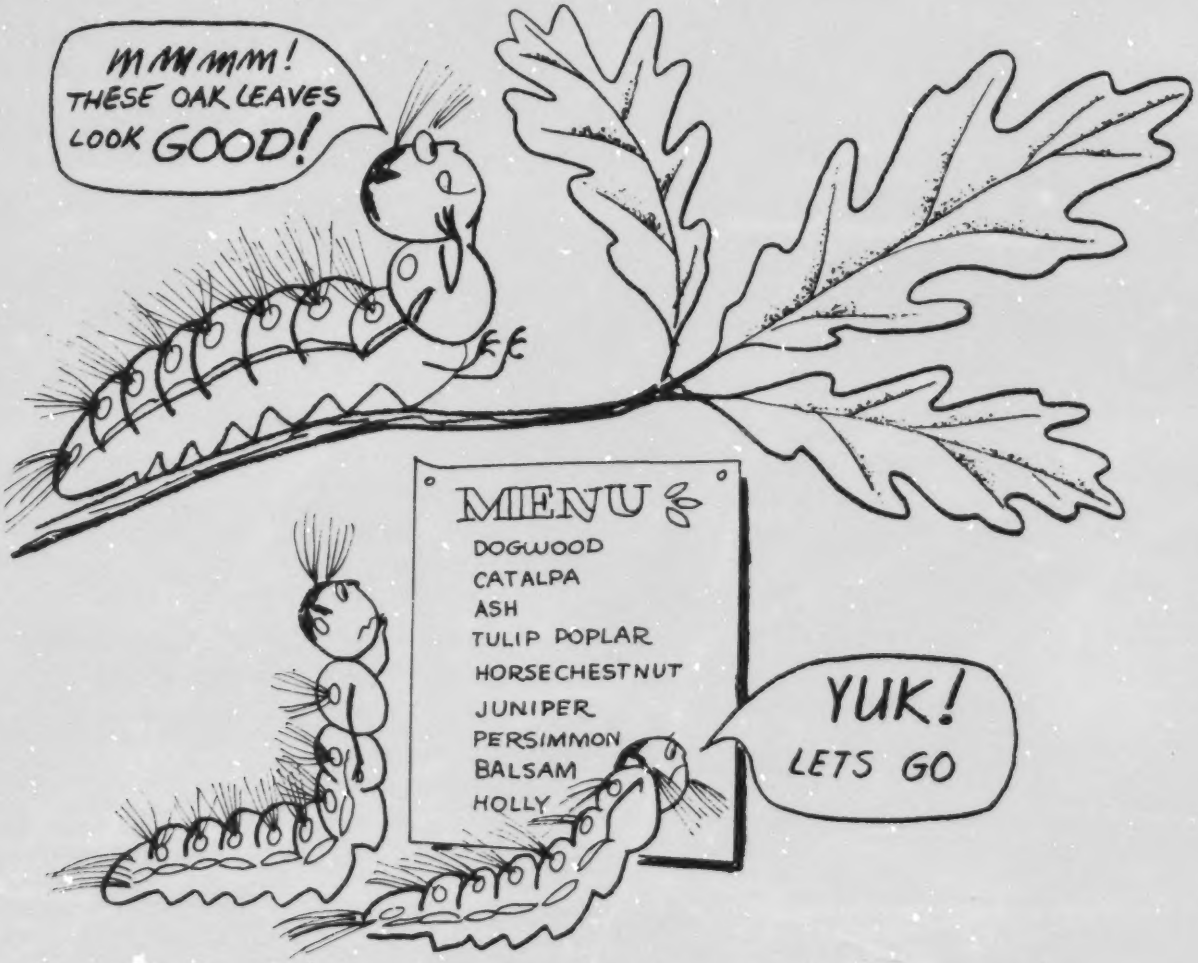
Age Class

INTRODUCTION: Gypsy moth caterpillars like to eat some tree leaves more than others. You can watch them and determine this for yourself. To help you remember which leaves you saw caterpillars eating, you may want to make a pressed leaf collection. It's easy!

MATERIALS NEEDED: Newspapers, boards, belt, glue, pencil, paper, and ring binder.

INSTRUCTIONS: Collect a pile of newspapers (or use an old catalog) and place a flat board on both the top and bottom. Tie a belt around the boards and paper. This is your plant press. Collect leaves and place them between the papers of the press. Let the leaves dry for several days and then glue them to a piece of paper with the name of the tree on it. Now place your mounted leaves in a collection folder.

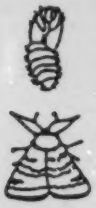
You may want to collect all kinds of leaves or only those you have seen gypsy moths eating. To help you get started, your teacher has a list of trees gypsy moths like and a list of trees they dislike.



TEACHER PROJECT

11

Age Class



LEAF EATERS

OBJECTIVE: To develop identification skills of tree-defoliating caterpillars.

INSTRUCTIONS: Explain that there is a wide variety of leaf-eating insects that periodically defoliate hardwood trees in the Eastern United States. Occasional defoliations during the life of a tree or forest probably have little effect on overall growth, but several years of defoliation can have significant negative impacts. Therefore, it is important to know about tree defoliators or leaf eaters.

In addition to the gypsy moth, which is a major hardwood defoliator, there are other caterpillars which can also defoliate trees. Some of these are often confused with the gypsy moth. Interested students should be encouraged to study the various insects to enable them to properly identify the important species.

The accompanying chart describes important characteristics that will distinguish one defoliator species from another. Encourage students to study these characteristics, collect and preserve (in rubbing alcohol) specimens, and color the illustration page of this project.

Additional Reading:

Major Hardwood Defoliators of the Eastern United States, Gypsy Moth Handbook, Robert A. Talerico, U.S. Department of Agriculture, Home and Garden Bulletin No. 224, 1978.

Eastern Forest Insects, Whiteford L. Baker, U.S. Department of Agriculture, Forest Service, Miscellaneous Publication No. 1175, 1972.

LEAF EATERS

STUDENT PROJECT 11

Age Class

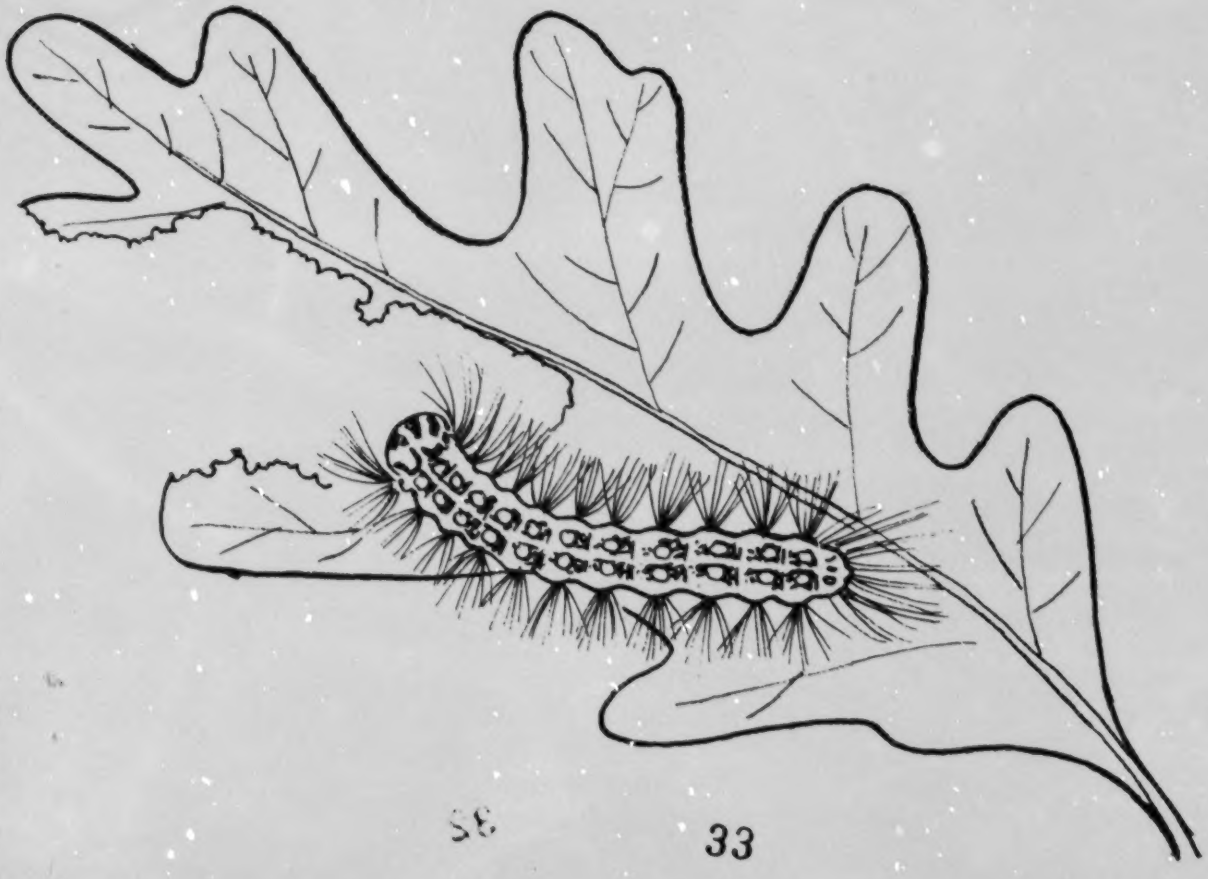
INTRODUCTION: Many different insects eat tree leaves. Most of these insects are the immature stages of moths or butterflies, called caterpillars or larvae.

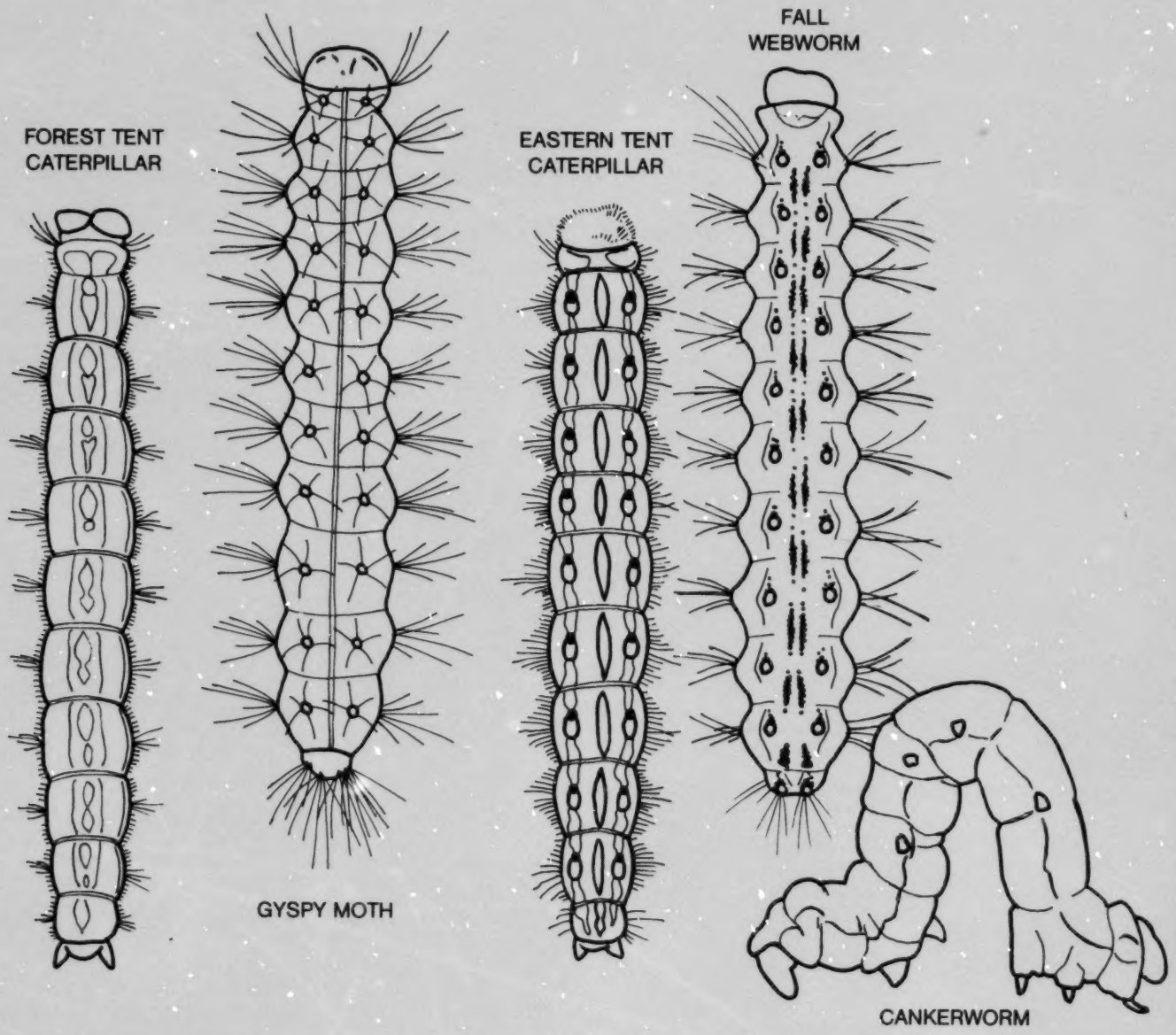
The larvae of the gypsy moth are important tree-leaf eaters, or defoliators. Other caterpillars are often confused with the gypsy moth, but with a little study it is fairly easy to tell them apart.

MATERIALS NEEDED: Crayons or colored pencils, rubbing alcohol, vials, and labels.

INSTRUCTIONS: Using the list of characteristics of five leaf-eating caterpillars on the next page, you can distinguish the gypsy moth larvae from caterpillars often confused with it. To make a colored guide of these caterpillars, read their descriptions and color the illustrations on the following page.

You may also want to make a collection of caterpillars that you find in your own yard or nearby forest. Collect caterpillars and place them in vials of rubbing alcohol to preserve them. You should also label the vials with the date, host, and caterpillar name. Identify the larvae using the list of characteristics or other references provided by your teacher/leader.




FOREST TENT CATERPILLAR
GYSPY MOTH
EASTERN TENT CATERPILLAR
FALL WEBWORM
CANKERWORM

CHARACTERISTICS OF LEAF-EATING CATERPILLARS

	GYPSY MOTH	FOREST TENT CATERPILLAR	EASTERN TENT CATERPILLAR	FALL WEBWORM	CANKERWORM
COLOR AND MARKINGS OF LATE-INSTAR CATERPILLARS	Velvety grey-black. Head yellow with dark lines. Five pairs of blue spots near head, followed by six pairs of red spots.	Black. Cream-colored keyhole marks down middle of back. Sides blue. Head blue.	Black. White stripe down middle of back. Blue spots along each side. Head black.	Pale yellow, green, or brown. Two rows of black spots down middle of back. Head black or red.	Green, with lemon-yellow stripe on each side. Head amber.
HAIRS	Dark, bristly and prominent. Concentrated at knoblike bumps.	Tan, soft, and not prominent. No knoblike bumps.	Tan, soft, and not prominent. No knoblike bumps.	Pale yellow to brown. Numerous.	None.
TENT OR WEB	None.	No tent, but sometimes a silken resting pad.	Large tent in fork of branches.	Large web at tip of branches.	None.
EGGS	Laid June–July. Egg mass covered by tan or cream-colored fuzz. Caterpillars hatch in late April–May.	Laid in July on aspen and maple twigs. Egg mass resembles part of twig. Caterpillars hatch in mid-April.	Laid in July on apple and cherry twigs. Resemble part of twig. Caterpillars hatch in early April.	Laid in May on various kinds of leaves. Eggs pale yellow in patches on leaves. Caterpillars hatch from May to August.	Laid November–March on bark or twigs high in tree. Dull grey. Caterpillars hatch April–May.
PUPAE	No outer cocoon. Pupae mahogany-colored. Found almost anywhere.	Outer cocoon yellow to creamy white. Found in vegetation.	Outer cocoon yellow to creamy white. Found in vegetation, on houses, etc.	No outer cocoon. Pupae occur in the soil.	No outer cocoon. Pupae are in the soil.
FAVORED HOSTS	Oaks, apple, beech, birch, alder, willow, hawthorn, sumac, chestnut, etc.	Primarily aspen and maple.	Wild cherry and apple.	Numerous trees and shrubs.	Apple, elm, oak, maple, hickory, ash, and others.

NOTE: For help in positive identification of insect larvae and control recommendations, consult local agricultural extension agents, arborists, or U.S. Department of Agriculture, Forest Service pest management specialists.

TEACHER

PROJECT

12

Age Class

SCAVENGER HUNT

OBJECTIVE: To develop data-collection skills, perform a community service, and participate in friendly competition.

INSTRUCTIONS: Almost everyone loves a scavenger hunt. This one can be a valuable learning experience, a partial gypsy moth control effort, and lots of fun!

This scavenger hunt can be held by your class, club, family, or group anytime between July and April. Gypsy moth eggs are laid in July and remain inactive for 9–10 months. They are the subject of this hunt, which is designed to take place over a several-week period.

At the first meeting of the club or class, students are given information about the gypsy moth. They may have already completed some other projects that made them familiar with the moth and its habits. They are also given the instructions for the scavenger hunt (i.e., they are to collect as many gypsy moth egg masses as they can and record where they collect them).

In between the first and second meetings, the students conduct their scavenger hunt. It will truly be a scavenge since gypsy moths are known to deposit their eggs almost anywhere, although often inconspicuously. This has been an important means of gypsy moth spread, since eggs deposited on movable vehicles or household articles transported from one part of the country to another can initiate isolated or new infestations. As the students collect egg masses, they are to record the collection location in a notebook.

The group should be cautioned that the hairs on the egg masses may cause skin irritation; therefore, gloves may need to be worn.

At the group's second meeting, each participant turns in his or her notebook and collection of gypsy moth egg masses. The group then proceeds with another project.

Between the second and third meetings, the leader tallies each participant's score by: (a) total number of egg masses collected, (b) total number of collection sites, and (c) measurements of largest egg masses. The leader then destroys the egg masses either through incineration or by placing in a container of petroleum distillate such as kerosene and then discarding in the trash or burying in the garden.

At the third gathering of the group, the leader awards prizes to participants who collected:

1. The most egg masses.
2. Egg masses in the most number of places.
3. The largest egg mass.
4. An egg mass from the most unusual place.
5. The least number of egg masses (booby prize).

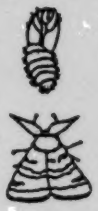
Not only will this scavenger hunt provide a valuable learning experience about the gypsy moth, but it will also help to develop data-taking skills, foster friendly competition, and reduce the number of gypsy moth egg masses. This can provide an important community service (worthy of media recognition) by helping to reduce the next year's population of gypsy moths. Although the scavenger hunt is easiest when populations are high, as a method of control it is only truly effective for low-level populations. It cannot be relied upon as an effective control technique since it cannot be expected that all egg masses will be found and destroyed.

SCAVENGER HUNT

STUDENT PROJECT

12

Age Class



INTRODUCTION: Here's a project you can have a lot of fun with while also learning more about the gypsy moth.

As you know, after female gypsy moths lay their eggs, the egg masses can be found almost anywhere—under bark, rocks, and boards; beneath picnic tables, house eaves, cars, and trucks; between firewood slabs, pieces of burlap, or flaps of canvas and almost everywhere else outside.

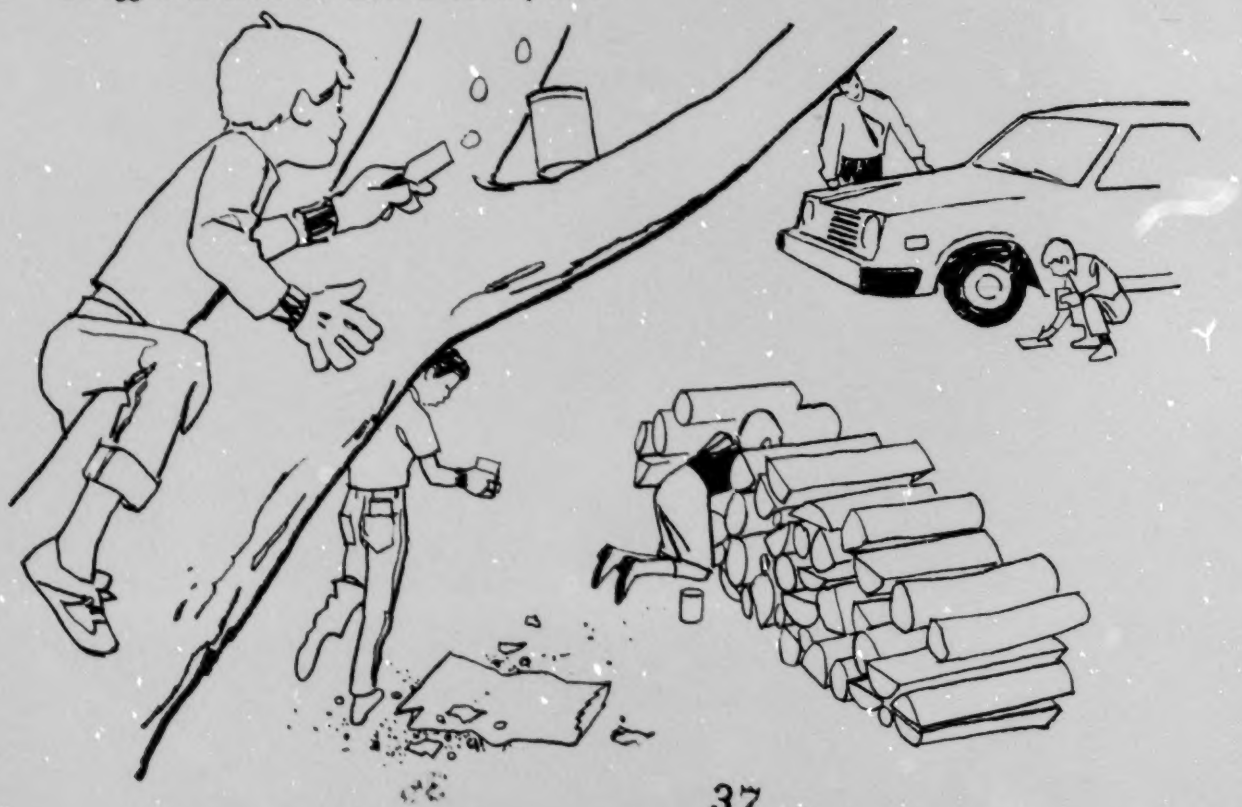
Ask your teacher or leader to help you organize a gypsy moth egg mass scavenger hunt.

MATERIALS NEEDED: Notebook, gloves, jar or can, and screwdriver or putty knife.

INSTRUCTIONS: After you are given the rules of the hunt, find as many gypsy moth egg masses as you can. Look in the most unusual places and try to find the largest masses you can. As you collect, write down in your notebook where you found each of your egg masses.

Remember that the hairs on gypsy moth egg masses can cause some people to have an itchy skin rash. To avoid this, wear gloves, and with a screwdriver or putty knife, scrape the egg masses you find into a can or jar.

At the end of the scavenger hunt, turn in your egg masses and your notebook and see if you won a prize for collecting: the largest egg mass, masses from the most places, or an egg mass from the most unusual place!



TEACHER

PROJECT

13

Age Class

RIKER MOUNT

OBJECTIVE: To develop audio-visual communication skills.

INSTRUCTIONS: One of the most visually effective tools available for teaching about insects is a collection of specimens of the various insect life stages. Important information can be passed along both during the collection process and in describing the collection to others.

Entomologists (scientists who study insects) often use flat, glass-covered boxes lined with cotton to store and display various insect life stages. With your assistance, these boxes (Riker Mounts) can be created by interested students.

Encourage students to collect gypsy moth eggs, larvae, pupae, and adults. Egg masses and pupae can be made nonviable by soaking them in kerosene and then drying. Larvae are best stored in vials of rubbing alcohol (although they may lose some color). Adults can be dried with their wings positioned either in full flight or at rest. If desired, the leaves of appropriate host plants may also be dried (see Project Number 10) and added to the display.

When all life stages have been collected and prepared, place them in an appropriate position in the bottom (cotton-covered) half of the box. One or two mothballs (para-dichlorobenzene) placed in corners will prevent destructive insects from entering and feeding on the dried specimens. Once the life stages are positioned and labeled, the glass-covered lid is placed on the box. The lid is held in place by pins inserted into the sides of both the top and bottom halves of the box after it is closed.

Completed Riker Mounts will last indefinitely and can be used often in future learning sessions.

RIKER MOUNT

STUDENT PROJECT 13

Age Class

INTRODUCTION: You know how easy it is to recognize things in nature that you have seen pictured in books. Another way to learn about things from nature is to collect and display them so you can "SHOW and TELL" others.

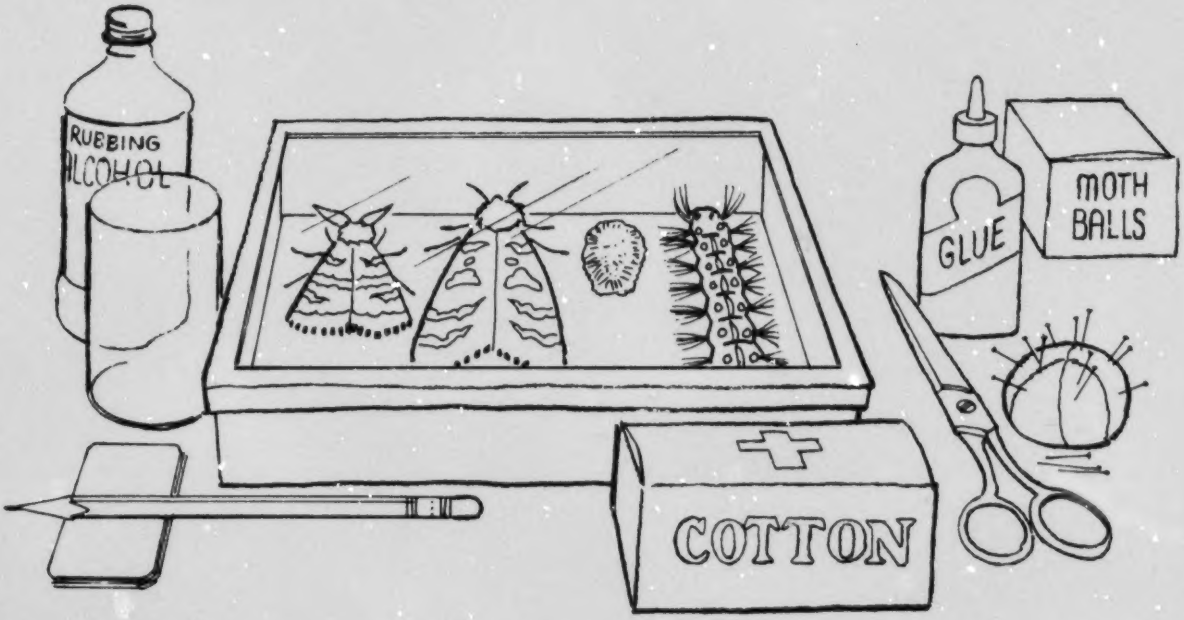
One way to do this is to build what scientists call a Riker Mount. This is a flat, glass-covered box lined with cotton. Here's how to make one in which to store your collection of gypsy moth life stages.

MATERIALS NEEDED: Flat box, scissors, cotton, glass or clear plastic, pins, glue, labels, pencil, mothballs, vials, and rubbing alcohol.

INSTRUCTIONS: Find a sturdy flat box (maybe one that a shirt, tie, or scarf came in). Cover the bottom half with cotton. Cut the center out of the top, leaving a "window" with a ridge and sides. Find, or have the teacher cut for you, a piece of glass or clear plastic, and glue it to the inside of the top of the box.

Collect the four gypsy moth life stages you already know about and place them on top of the cotton. The larvae should be stored in vials of rubbing alcohol, and the egg masses, pupae, and adult moths should be dried. You may also want to add some dried oak leaves or other plants to show what kinds of food gypsy moths like. Write the names of the life stages on small pieces of paper and put them next to the appropriate specimens as identification labels. Add one or two mothballs to the corners of the box to keep other insects out. Cover with the see-through lid.

You now have a completed Riker Mount of gypsy moth life stages. Keep the lid from falling off by putting pins through the sides. Now share your "SHOW and TELL" display with your friends, parents, and neighbors.



TEACHER

PROJECT

14

Age Class

BURLAP COLLECTOR

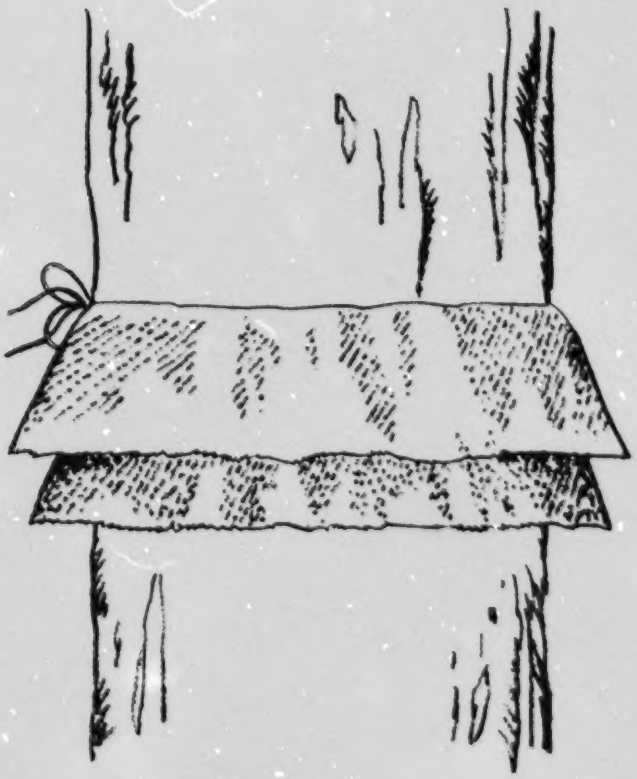
OBJECTIVE: To learn about daily gypsy moth feeding activities and to participate in a community service project.

INSTRUCTIONS: Explain that late-instar larvae of the gypsy moth often seek places to rest during the day. They do this either in trees or on the ground, often moving between the two places. Burlap bands or skirts placed around the trunk of favored tree species such as oak can be used to intercept migrating larvae. From late May through mid-July larvae climbing down the trees will crawl beneath the burlap where they can be easily detected. They can then be periodically removed and destroyed.

Burlap strips should be about 8 to 12 inches wide and attached 3 to 5 feet above the ground. A piece of string or rope should be tied around the tree and the burlap folded over it. The fit should be rather loose, to allow larvae to crawl beneath the folds.

Intercepted larvae should be removed daily in the late afternoon and destroyed. This hand-picking of larvae in light to moderate infestation areas may prevent heavy defoliation of valuable shade trees.

NOTE: When collecting larvae, wear gloves to avoid human skin irritation from larval hairs.



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BURLAP COLLECTOR

STUDENT PROJECT

14

Age Class

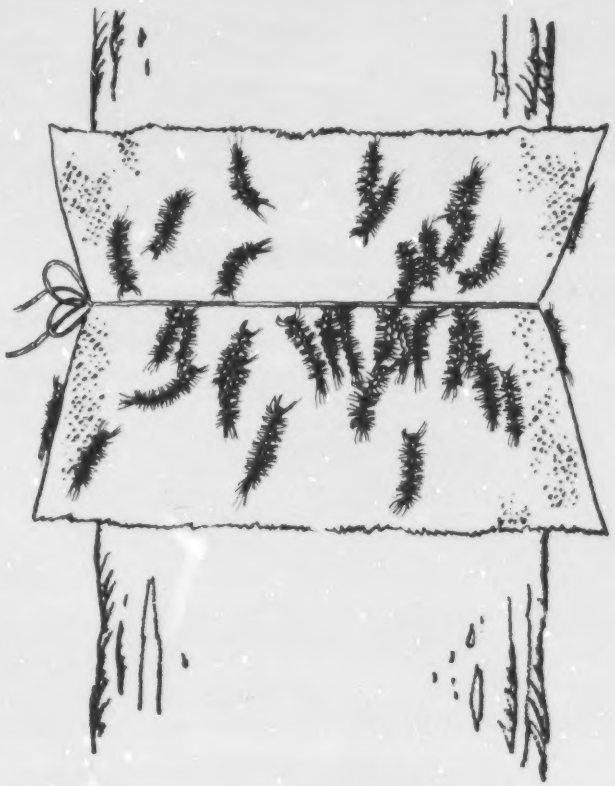
INTRODUCTION: You say you want to save the leaves on your favorite tree? Here's a way to stop some gypsy moths from eating all those leaves.

Since large gypsy moth caterpillars only feed at night, they crawl up and down tree trunks during the day. You can trap, collect, and destroy these caterpillars by making a simple burlap collector.

MATERIALS NEEDED: Burlap or similar fabric, string or rope, and an old can or jar.

INSTRUCTIONS: Cut a piece of burlap about 8 to 12 inches wide and long enough to wrap around the tree. With a piece of string or rope, tie it around the tree at shoulder height. Fold the upper half of the burlap over the lower half and let it hang. In May or June, caterpillars will hide beneath the burlap in the daytime and you can collect them in an old can or jar and destroy them. In areas where there are few caterpillars, this can be an effective, low cost, natural way to keep your trees green.

NOTE: When collecting larvae, wear gloves to avoid human skin irritation from caterpillar hairs.



TEACHER PROJECT

15

Age Class

LIFE HISTORY STUDY

OBJECTIVE: To develop observation, experimentation, and data collection skills.

INSTRUCTIONS: The life history of an insect is a record of all that the insect does and all the changes in form that it undergoes from the beginning of its life until its death. Studies of life histories can be fascinating, and although they usually require observations in nature, they can be supplemented by home or school study. This latter type of study can be done by simply setting up an insect rearing cage and studying the insect by observation and experimentation. Through observation, a student can learn an insect's normal pattern of life. Through experimentation, changes in pattern of life can be studied under varying conditions.

To assist students in their understanding of the gypsy moth's life history, encourage them to set up an insect rearing cage. Simple cages can be made from wide-mouthed, glass jars that have perforated lids. More elaborate cages can be made from clear plastic containers or screened-in boxes. Criteria for a good rearing cage include: securability, accessibility, visibility, portability, and adequate ventilation.

Once a cage has been selected, and depending on the time of the year, the appropriate insect life stage may be introduced. Usually this will be either an egg mass or several small larvae. If an egg mass is used, remember that it can contain anywhere from 100 to 1,000 eggs, which could result in too many larvae to maintain in a confined space. If larvae are introduced, then appropriate food plants should be included. Remember that oak is the preferred host plant. As an experiment, students should be encouraged to try several different kinds of leaves. They can then compare for themselves those that are preferred with those that are not. See lists which are a part of Project Number 10.

Through observation, experimentation, and note-taking, students can learn much about the life history of the gypsy moth.

LIFE HISTORY STUDY

STUDENT PROJECT 15

Age Class

INTRODUCTION: If you have ever had a pet, you know that it likes to eat some things but doesn't like others. Your pet may also act certain ways that are different from your friend's pet. These different habits are part of their life history.

You can have an *insect* for a pet, and you can watch its habits through time. We call this a study of life history.

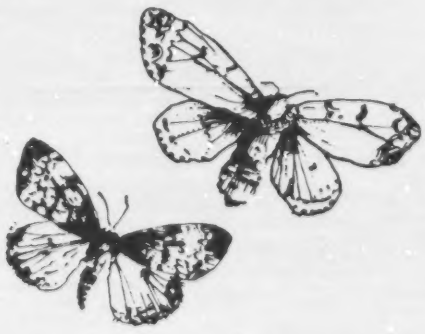
For an insect like the gypsy moth, a study of its life history does not take very long. You can make an insect rearing cage and watch your insect pet grow.

MATERIALS NEEDED: Rearing cage made from glass jar, plastic container, or screened-in box; small water jar to put plant branches in; notebook; and pencil.

INSTRUCTIONS: Make sure that the large jar, plastic box, or screened-in cage has small holes in it so the insects have air, but also make sure it has a tight fit so your insects do not get away. Next, find the gypsy moth life stage that you want to begin with. If you start with eggs, you will not need to add food. But when your larvae hatch or if you begin with larvae, you will need to add food that they like. You should remember that gypsy moth larvae like oak leaves best, but they will eat about 500 other kinds of plants. You can experiment with different kinds of plants by offering them as food. You can write in a notebook which foods were liked and which were not liked.

Here are several things to remember about keeping gypsy moths as pets:

1. If you start with eggs, remember that each egg mass has 100 to 1,000 eggs in it and you may not want to keep all the caterpillars.
2. Gypsy moth egg masses and larvae have fine hairs on them. These can cause skin itches for some people, so you may want to wear gloves if you handle your pet.
3. Large gypsy moth larvae can eat many leaves a day so don't forget to feed them.
4. Try to keep your pets through as many stages of their life as you can. If you watch them go from egg to larvae to pupae to adults and have the adults lay eggs, you have observed an entire gypsy moth life cycle.



TEACHER PROJECT

16

Age Class

NATURE PHOTOGRAPHY

OBJECTIVE: To develop photographic and communication skills.

INSTRUCTIONS: Photography—especially close-up photography—can aid in the instruction of many fields of learning. Teachers of the natural sciences often make abundant use of close-up photographs.

Photography also allows natural science teachers to put the tools of learning into the hands of the students through the use of simple, inexpensive cameras.

Natural science students can enhance their learning and express it to others by taking life-history, ecological, and yes, even sociological pictures.

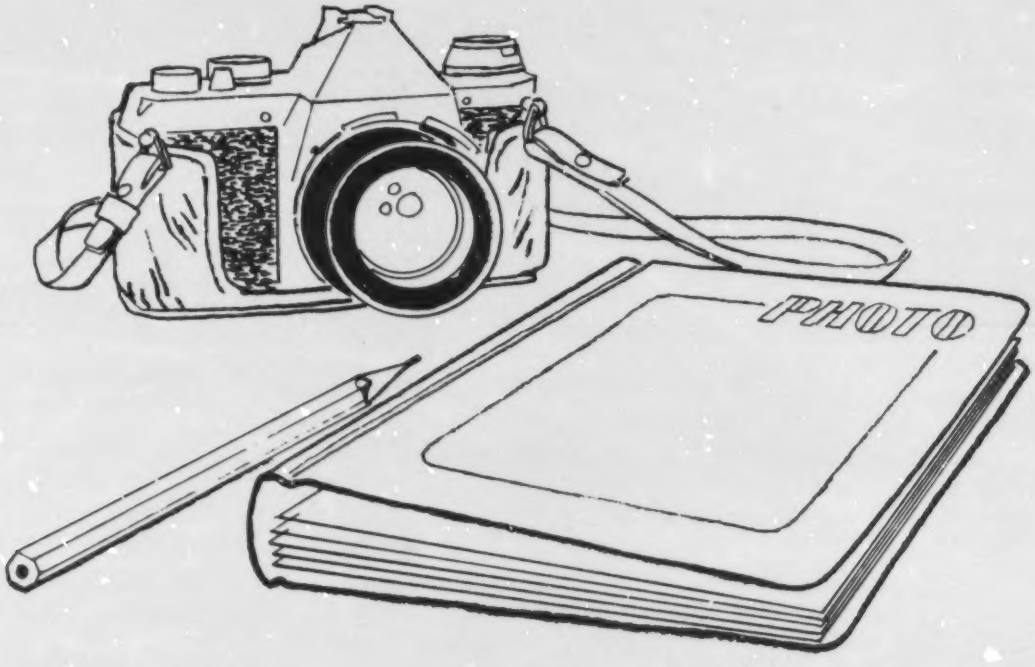
Encourage students with owned or borrowed cameras to take close-up photographs to document the life-history stages of the gypsy moth. Photographs of host trees can show incidences of gypsy moth damage. Exceptional or unusual sights should be recorded. A contest can be staged to determine the best photograph by a student. The winner's photograph can also be submitted to other photographic competitions or to the local media.

Several books are available to assist amateur natural science photographers. They include:

Natural Science Photography, Laboratory and Field Procedures, H. Ross Jackson, Resources Branch, Agriculture Canada, Ottawa, Ontario, Canada, 1972.

Closeup Photography, Kodak Tech. Pub. N-12-A, Eastman Kodak Co., Rochester, NY, 1969.

Insects Close Up, Univ. of Calif., Berkeley, CA, 1953.



NATURE PHOTOGRAPHY

STUDENT PROJECT 16

Age Class

INTRODUCTION: Have you ever heard the saying, "A picture is worth a thousand words?" If you question it, this project may be for you.

MATERIALS NEEDED: Camera, film, notebook, and pencil.

INSTRUCTIONS: No matter whether you own a camera or have to borrow one, or what its quality is, you can do this project and learn a lot about nature photography and the gypsy moth at the same time.

If you ever had to describe an insect in detail to anyone, you know that it is difficult. If you have pictures to show, it becomes a lot easier.

To create your own set of story-telling pictures about the gypsy moth, photograph its life stages. Create a true-to-life sequence of pictures from egg to adult. You may also select an unusual gypsy moth situation to photograph.

Here is a list of simple guidelines to remember when doing nature photography:

1. Keep your subject simple—each photograph should depict only one item.
2. Use good lighting, avoid shadows.
3. Select your backgrounds carefully; colored paper placed behind a subject may reduce confusion and enhance clarity.
4. Use color film when it is important to show distinguishing characteristics; use black and white film when specific coloration is not important.
5. Position specimens to show them to the best advantage.
6. Place active insects in a refrigerator briefly to slow their activity during photography sessions.
7. In a notebook, record important information about the specimen or scene. Also record camera settings, distances to specimens, and other data which could be useful to other photographers or to recreate a situation.

The photographs you take can benefit other projects you do. You may also find that the local newspapers may be interested in sharing with their readers your photographs of exceptional or unusual situations relating to the gypsy moth.

TEACHER

PROJECT

17

Age Class

TIME LINE

OBJECTIVE: To develop pictorial graphics skills.

INSTRUCTIONS: In 1869 Leopold Trouvelot, a French astronomer working at Harvard University, accidentally released several gypsy moth caterpillars that he had imported from Europe. His aim was to breed them with other moths to develop a new race of silk-producing insects. The escaped insects became established in a vacant lot next to his home. From 1869 to 1900 the gypsy moth spread through many parts of Massachusetts, in spite of extensive control efforts. In 1901 gypsy moth infestations were discovered in Rhode Island, and in 1905 and 1906 they were found in New Hampshire and Connecticut, respectively. By 1912 the gypsy moth population had spread to Vermont.

To compound the problems, in 1920 the gypsy moth was again introduced into the United States. This time it came into New Jersey on blue spruce trees imported from the Netherlands. In 1927 gypsy moth defoliation in infested states topped 100,000 acres. Serious infestations were discovered in 1932 near Scranton, Pennsylvania, and in 1938 a hurricane helped to spread caterpillars far and wide. Control efforts were varied and extensive during the 1940's. In 1948 the gypsy moth was thought to be eradicated in Pennsylvania. By 1953 populations resurged and defoliation topped 1 million acres that year. Population surges and declines occurred in the 1960's and 1970's, but the spread of the moth continued slowly. In 1979 noticeable damage was recorded in Maryland and Delaware. In 1980 defoliation topped 5 million acres, and by 1981 visible defoliation occurred on 12 million acres from Maine to Maryland.

Using the accompanying map (Figure 1) and the chronology above, explain about the spread of gypsy moth defoliation. In addition, explain that isolated infestations occur in Illinois, Indiana, Michigan, Ohio, Virginia, North and South Carolina, Arkansas, Wisconsin, California, Nebraska, Alabama, Oregon, and Washington.

You may also want to indicate that the type of forest susceptible to gypsy moth defoliation, although concentrated in the eastern United States, extends from coast to coast. The map of the United States in Figure 2 indicates potential defoliation areas based on the presence of hardwood trees favored by the gypsy moth.

Using the blank map, encourage students to appropriately designate (1) current infestations; (2) gypsy moth spread through time, or (3) susceptible forests and/or isolated infestations.

To further their learning, encourage students to identify ail states and state capitals.

TIME LINE

STUDENT PROJECT 17

Age Class

INTRODUCTION: The gypsy moth is a serious defoliator of forest, shade, and fruit trees in the United States. Using this time line, and additional information from your teacher/leader, you can learn how this happened and understand the course of events.

MATERIALS NEEDED: Teacher's instructions and colored pencils.

INSTRUCTIONS: Using the following gypsy moth time line and additional information provided by your teacher/leader, create a map of real or potential gypsy moth spread.

1869: French astronomer accidentally releases gypsy moth caterpillars at Medford, Massachusetts.

1890–93: Extensive efforts to control the gypsy moth in Massachusetts.

1901: Gypsy moth infestations discovered in Rhode Island.

1905–06: New Hampshire and Connecticut report gypsy moth populations.

1912: Spread of gypsy moth infestation reaches Vermont.

1920: Gypsy moth defoliation covers 100,000 acres.

1932: Scranton, Pennsylvania, reports gypsy moth.

1938: East Coast hurricane spreads gypsy moth beyond previously infested areas.

1940: Extensive control efforts by various government agencies including the Federal War Department.

1948: Gypsy moth thought to be eradicated in Pennsylvania.

1953: Populations of the gypsy moth resurge and defoliation tops 1 million acres.

1960–70: Gypsy moth populations fluctuate locally with some spread.

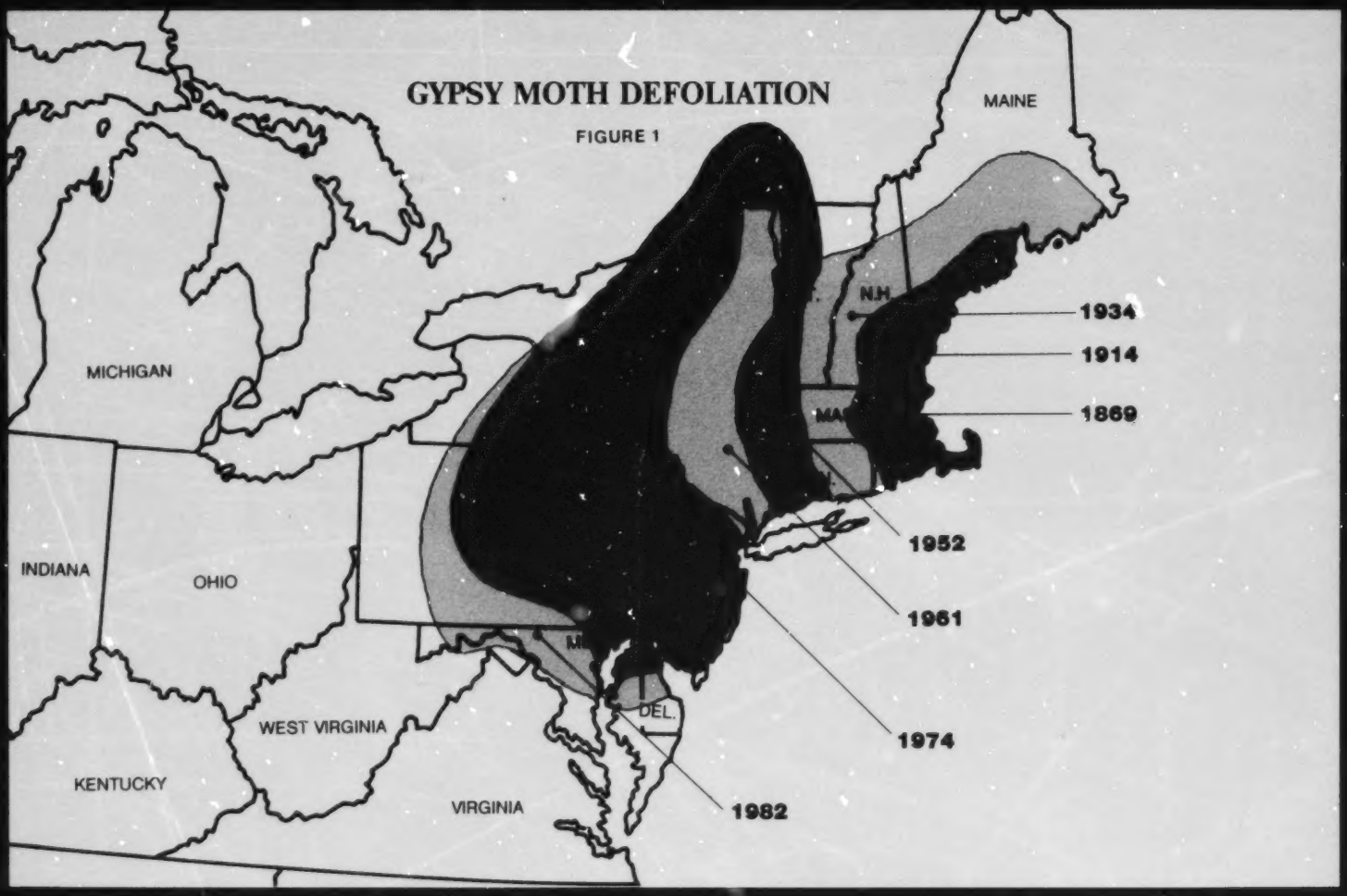
1979: Defoliation from the gypsy moth detected in Maryland and Delaware.

1980: Defoliation tops 5 million acres.

1981: Infestations from Maine to Maryland cause visible defoliation to occur on 12 million acres.

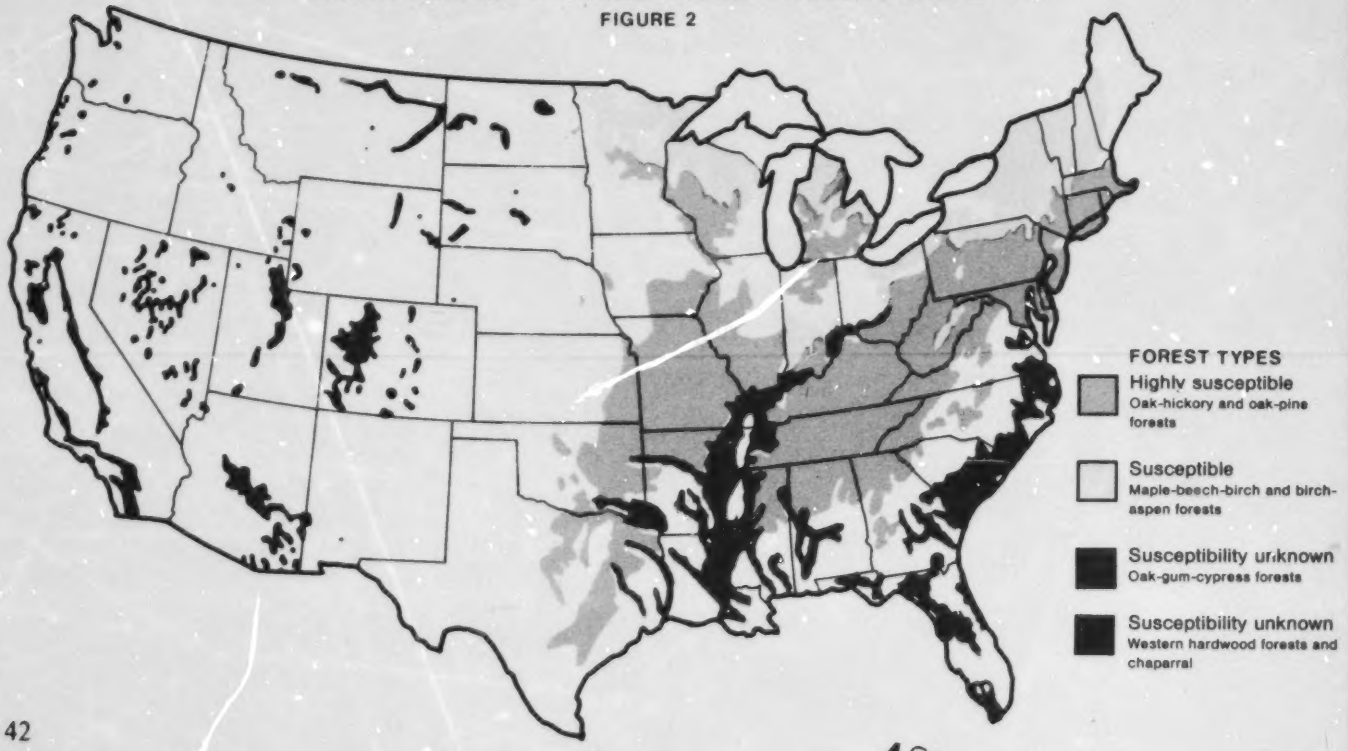
GYPSY MOTH DEFOLIATION

FIGURE 1



GYPSY MOTH SUSCEPTIBLE FOREST TYPE

FIGURE 2



THE UNITED STATES OF AMERICA

49

50

TEACHER

PROJECT

18

Age Class

MOTH WATCH

OBJECTIVE: To develop data collection skills and participate in a community service project.

INSTRUCTIONS: Traditionally, pesticides and other kinds of direct control methods have been used to reduce the adverse effects of the gypsy moth on hardwood trees and on people. Recently, however, new technology has been developed that uses a subtler approach to gypsy moth population management. This approach interrupts the adult moths' reproductive cycle by attracting and trapping male moths, thus preventing them from mating with females. It is not a foolproof approach to gypsy moth control, but it has been proven effective for monitoring adult male moth populations. It is also useful where the populations are low enough (less than 10 egg masses per acre or 20 per city block) so that its use may reduce the number of leaf-eating caterpillars the following spring.

Here's why the system works. When the flightless female gypsy moths emerge from the pupa and are ready to lay their eggs, they release a powerful scent called a pheromone. This pheromone is like a perfume to male moths, and it stimulates them to find and fertilize the females.

Scientists have been able to synthetically produce the pheromone. This material, called disparlure, is now being incorporated into slow-release plastics; it attracts unsuspecting males into traps where they can be killed and destroyed. Your students can be encouraged to perform an important community service by catching, counting, destroying, and reporting on trapped male moths. Here's how.

Obtain manufactured gypsy moth traps from local distributors (they are sold under a variety of trade names). Distribute traps to students and encourage them to hang the traps (after getting permission) on non-oak trees in their neighborhood. The traps come with a packet of disparlure and a strip of pesticide-impregnated plastic (similar to that used in pet flea collars). Since the disparlure is a concentrated attractant, minimize the possibility of having moths attracted to objects other than the traps (such as your students) by having your students wash their hands thoroughly with soap and water after hanging the traps. This same procedure is essential after all handling of the pesticide strips. PESTICIDES USED IMPROPERLY CAN BE INJURIOUS TO MAN AND ANIMALS, AND ALL LABEL PRECAUTIONS MUST BE FOLLOWED.

Have students place traps at a concentration of about four per acre (or 8 per city block) from about mid-June to September. Encourage students to:

1. Check the traps frequently.
2. Record the numbers of captured adult males.
3. Empty and destroy trapped males.
4. Visit with their neighbors about their gypsy moth management efforts.
5. Contact local officials about the end results of their trapping efforts.

If students, their parents, friends, or neighbors ask questions about other actions that can be taken to control the gypsy moth, have them consult a representative of the county cooperative extension office, the State Department of Agriculture, or a local urban pest specialist.

MOTH WATCH

STUDENT PROJECT

18

Age Class

INTRODUCTION: The gypsy moth is a well-established insect in most of the northeastern part of the United States. If it is new to your area, however, or if it is at low population levels, there is a way you can perform an important community service and help reduce the effects of the gypsy moth on trees and people.

If you already know about the biology and life history of the gypsy moth, you know that from about mid-June to September male moths fly around trees in zigzag patterns searching for flightless females. They are attracted to the females because of a smell they emit, which scientists call a pheromone. You can fool male moths by luring them into traps that contain a man-made pheromone called disparlure. Scientists use this trapping technique to determine how many moths are in an area. You can do it too and help to reduce the numbers of males that can mate with females. This can lead to a reduction of caterpillars the next spring.

MATERIALS NEEDED: Commercial gypsy moth trap, notebook, and pencil.

INSTRUCTIONS: Assemble the trap according to directions. Place the pheromone and pesticide strip on the inside. REMEMBER THAT PESTICIDES USED IMPROPERLY CAN HARM MAN AND ANIMALS. FOLLOW ALL LABEL DIRECTIONS. AFTER HANDLING, WASH YOUR HANDS WITH SOAP AND WATER. Get permission to hang the traps in non-oak trees. Leave the traps up from about mid-June to September. Check your traps frequently. Once you begin catching adult male moths, empty your traps frequently. Keep track of the number of male moths you catch and destroy.

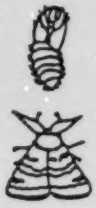
After September, when you have recorded all of your catches, compare them with the catch of your friends, and contact local officials about the levels of infestation in your neighborhood.

TEACHER

PROJECT

19

Age Class



CROSSWORD QUIZ

OBJECTIVE: To develop spelling skills and increased vocabulary, especially of words associated with the gypsy moth.

INSTRUCTIONS: Although many of the words used in the crossword puzzle relate to the gypsy moth, some may be unfamiliar and your assistance may be needed. Answers are on page 78.

ACROSS

1. Gypsy ___
5. Larval spot color
9. Worm fiber
13. Succulent plant
17. Breezy
21. Masked mammal
25. Fruit
29. Woody plant
33. Foot digit (2 words)
37. Turfs
41. Oceans
45. Receive
49. Larval spot color
52. Body spirit
56. Favorite gypsy moth food
59. Dread
62. Against
66. Solid water
69. Taxus
72. Glimpse
76. Was at front
79. Bad bug
83. Opposite of death
87. Hornet
91. Growth medium
95. Inactive
99. Cookie
103. Nursemaid
107. Food
111. Grow
115. On edge
119. Sacks
123. Brand

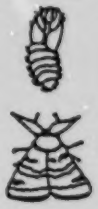
DOWN

1. Charts
2. Margarine
3. Frog cousin
4. Opposite of his
5. Winged mammals
6. Italian money
7. Urine
8. Ocelli
9. Go away
10. Infinitesimal amount
11. View
12. Leg joint
49. Sun beam
50. Female sheep
51. Morning moisture
52. Tree liquid
53. First
54. Indian
55. Labrum
56. Petroleum
57. Playing card
58. Sheep tick
79. Window glass
80. Mild oath
81. Past tense of sing
82. Platter
83. Tree branch
84. Thought
85. Banner
86. Snakelike fishes
87. Caterpillar
88. Field
89. Parch
90. Swine

CROSSWORD QUIZ

STUDENT PROJECT 19

Age Class



INTRODUCTION: The topic of this crossword quiz is the same as the answer to No. 1 across. Try it.

MATERIALS NEEDED: Pencil.

INSTRUCTIONS: Using the clues provided, write in the correct answers across and down.

1	2	3	4	5	6	7	8	9	10	11	12
13	14	15	16	17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32	33	34	35	36
37	38	39	40	41	42	43	44	45	46	47	48

49	50	51		52	53	54	55	56	57	58	
59	60	61		62	63	64	65	66	67	68	
69	70	71		72	73	74	75	76	77	78	

79	80	81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100	101	102
103	104	105	106	107	108	109	110	111	112	113	114
115	116	117	118	119	120	121	122	123	124	125	126

TEACHER PROJECT 20

Age Class

PESTICIDES AND ALTERNATIVE ACTIONS

OBJECTIVE: To learn about a sometimes controversial topic.

INSTRUCTIONS: This project is designed to encourage students to understand that although pesticides can create problems if used improperly, they are still an essential part of a new decision-making process that has come to be known as Integrated Pest Management or IPM.

What IPM does is to consider a variety of control tactics designed to exploit weak points in a pest's life cycle. It involves educating everyone about a pest, the damage it causes, control strategies, and management options. The objective is to keep damages and losses at an acceptable level. Management tactics often combine biological, mechanical, cultural, and chemical methods along with natural control.

Read the following brief explanations about the kinds of problems that have resulted from the use of some pesticides. The references listed at the end of the project will be useful in preparing to answer student inquiries.

Problems with pesticides:

1. **Contamination of the Environment.**

   Improperly used, chemical pesticides can adversely affect the environment. They can enter aquatic systems in several ways: rain may wash pesticides into water from nearby areas that have been heavily treated; chemical wastes may be discharged into water by manufacturers; and careless pesticide users may accidentally contaminate streams, lakes, and other components of the environment. All of these situations can result in adverse effects on fish, aquatic insects, and other plants and animals.

2. **Resistance to Pesticides.**

   When a pest population is treated with a pesticide, most of the individuals in the population are killed. If a few individuals in the population have some immunity to the pesticide, they may not be killed. Their offspring will also have some immunity to the same pesticide. The next time the pest population is treated, many individuals survive. A stronger pesticide will be necessary to kill these individuals in the future.

   If a stronger pesticide is used, the pest population may develop resistance to this pesticide also. This in turn may lead to the use of a still stronger pesticide, and then more resistance. The result is continued use of larger quantities of stronger pesticides.

3. **Misuse of Pesticides.**

Pesticides are sometimes misused. If someone applies a pesticide without reading the label, they may apply too much or not enough pesticide. They may also apply a pesticide that will not kill the intended pest, or they may apply a pesticide that will kill what they are trying to protect.

Even someone who reads the label may not follow the instructions. They may decide that if the amount the label says to use is good, twice that much must be better. Applying more pesticide than the recommended amount adds to our environmental problems.

4. **Secondary Pest Outbreaks.**

When more than one species of pest is present in an area, large numbers of one species may prevent another species from increasing in number. If the area is sprayed with a pesticide to kill the abundant pest, the other (secondary) species may increase in number and become a problem.

5. **Nontarget Organisms.**

Some organisms help to control certain pest species. Application of pesticides may kill these beneficial or "good" organisms. In some cases, the beneficial organisms would be able to control the pest species if they were not sprayed.

6. **Resurgence.**

Some pest species reproduce rapidly if only a few are in an area. If this type of pest is sprayed with a pesticide, any individuals that survive will have an opportunity to produce many young. The next generation of the pest will be as large as or larger than the one that was sprayed. This results in a resurgence of the population.

7. **Energy Crisis.**

Petroleum resources are used at a number of stages in the manufacture and application of pesticides. Many ingredients in pesticides are made from petroleum products, and gasoline or diesel fuel is used in applying some pesticides. As petroleum resources become scarcer, the manufacture and application of pesticides will become more expensive. Pesticide users will look for other ways to control pests.

Because of these problems with conventional chemical pesticides, the new decision-making process called Integrated Pest Management (IPM) is receiving more attention. One of its purposes is to reduce our reliance on the use of conventional chemical pesticides.

For further information on IPM and alternatives to pesticides, see the appropriate references.

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PESTICIDES AND ALTERNATIVE ACTIONS

STUDENT PROJECT 20

Age Class

INTRODUCTION: The use of pesticides is often a controversial issue. This project will help you to understand why. It will also show you that there are alternatives to pesticides, but often these alternatives must be used in conjunction with the proper use of pesticides if we are to adequately protect our trees, forests, and families from insects like the gypsy moth.

MATERIALS NEEDED: Pencil.

INSTRUCTIONS: Read the two sets of explanations about pesticides and their alternatives, and complete the hidden word squares on the next page. (Consult with your teacher, leader, county extension agent, or pest control specialist if you have questions.)

Traditionally, the most common method of controlling insect pests such as the gypsy moth has been through the use of conventional chemical pesticides. However, decisionmakers have found that certain problems can result from our dependence on pesticides; they include:

1. Contamination of the environment—pollution from pesticides can be dangerous to people and animals.

2. Resistance to pesticides—due to overuse, some pests have developed an immunity to pesticides so that some chemicals no longer kill them.

3. Misuse of pesticides—sometimes more spray is used than is needed.

4. Secondary pest outbreaks—eliminating one pest can give another pest a chance to increase in numbers.

5. Nontarget organisms—sometimes pesticides can kill unprotected beneficial or "good" organisms as well as pests.

6. Resurgence—because nontarget organisms (like natural enemies) may be killed, surviving pests may have a good chance to increase in number.

7. Energy costs—many chemical pesticides are made from petroleum resources (oil and gas, for example), which are becoming scarce and costly.

These seven potential problem areas with chemical pesticides are hidden in the top letter square on page 53. Can you find them? Answers are on page 78.

In recent years a new concept of pest management has evolved. It is a decision-making process called Integrated Pest Management or IPM. IPM is an idea that encourages the use of many different ways to fight pests. IPM does not eliminate the use of pesticides, but it can reduce our dependence on them.

There are six major tactics that can be used in an Integrated Pest Management program. They include:

1. Cultural—planting and growing practices that reduce the damage pests do. For example, growing few oaks, the favored tree of the gypsy moth.

2. Mechanical—changing a pest's access to food, reproductive areas, or protection from natural enemies. For example, trapping male gypsy moths so they can't mate.

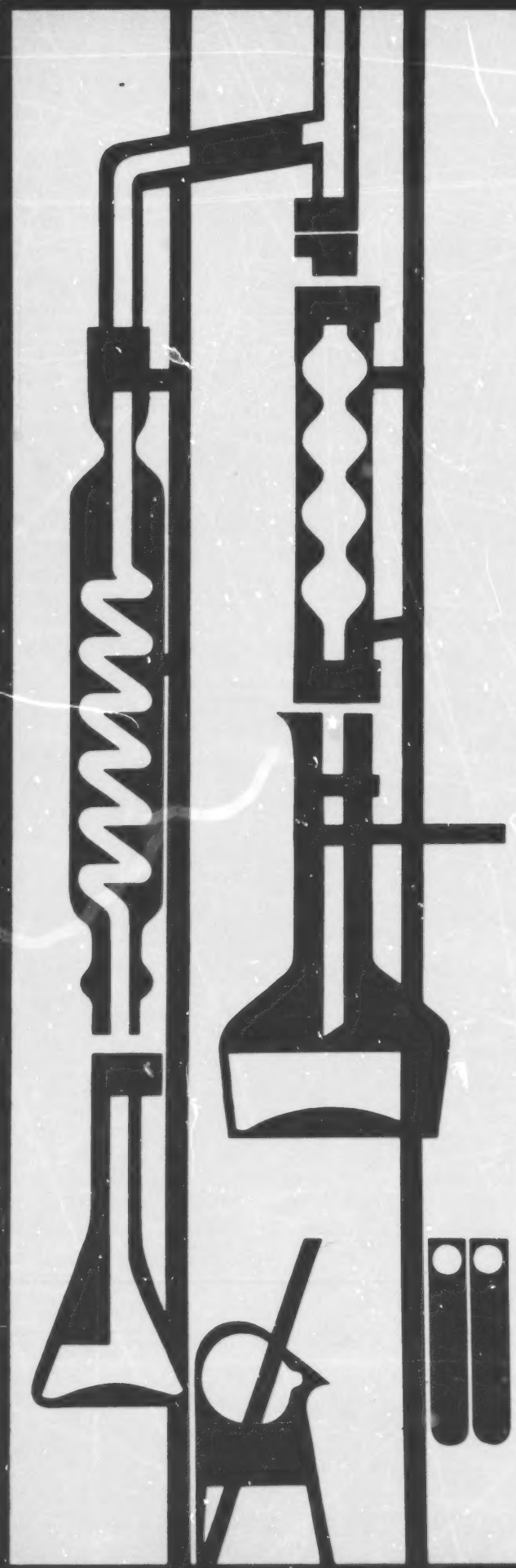
3. Manual—using techniques such as hand-picking egg masses and collecting larvae in burlap collectors.

4. Biological—adding and encouraging natural enemies such as parasites (flies and wasps), predators (beetles and birds), and pathogens (bacteria and viruses) to reduce pest populations.

5. Regulatory—quarantines are regulatory measures used to prevent a pest from entering a new area. Required inspection of household goods is a type of quarantine used to prevent gypsy moth introduction into new areas.

6. Chemical—using chemical pesticides to control pest populations will always be an important part of Integrated Pest Management programs. Decisions to use them, however, must be balanced with their potential hazards.

The six major tactics available for use in the IPM program are hidden in the bottom letter square on the next page. Can you find them? Answers are on page 78.



The seven potential problems with chemical pesticides are hidden in the letters below. They may read left to right or top to bottom. Can you find them?

A C D R Y T B H R C F N K R R F M S
F E W A C B I L P A E N G J E O P R
E W Q S K O L U N C Z O U R S E S D
F S K I C O N T A M I N A T I O N P
R G J I L O P T B J R T E W S C N O
E F H K M B V S E T V A C E T W T B
H D M I L E B J L A S R J T A B E R
R G K L E W Q A Z X N G K O N P Y R
E T H K U I R E W Q A E L R C T E Z
S E C O N D A R Y O U T B R E A K S
U R Y J K L U T R E W O A X C V G T
R E G J K O U Y T R C R A Q W E R I
G T J N V D W X C V B G N M L I G H
E F U Z C D E W J K G A D S A C V B
N J K L D E R T Y U B N C B N M E W
C S M P I O Y H T R E I C V B J U I
E N E R G Y C R I S I S V X U I Z W
W F T Y U I N M K I G M S U S E P
A W Q X V U O P M J U S H T R V E C

The six major tactics available for use in an IPM program for the gypsy moth are hidden in the letters below. They may be read from left to right or top to bottom. Can you find them?

D J K C U Y T B H R C F G K R F M S
F R P E K E H W X A U A D I S C B Y
E D S W U W B J V W L Q E P T B J K
F P N E Y Q E K Q X T W R O E S L L
R O N S T S W G W H U E T Y L T M U
E B T R B K V Z F T R R Y R Z J B M
H R O P H O E D T R A I U T X N I W
R M E C H A N I C A L S B W N V O T
E S O Y R L Q E H V M J A A O D L B
G T Y E C U R R E U E A C C P W O P
U I T N F C Y Y M A N U A L E X G Y
L H A T G Z J U I M W E C B J C I R
A B W V K U K B C T D M D I K V C E
T W Q I R R U O A I S T R R O B A S
O T I O F S T P L Q A Y T P U F L D
R M X A M D R J Y C C X Y N Y U S F
Y A V B S E E U S B V W B B T Z R M
W N M S O F B S M N B V M A R C T S
Z X Y P M Q S V X R A M Z Q V W C E

TEACHER

PROJECT

21

Age Class

READ THE LABEL!

OBJECTIVE: To develop an ability to read pesticide labels and understand their importance.

INSTRUCTIONS: Study this section on pesticides and pesticide labeling, and encourage students to carry out their project, which will lead them to a listing of pesticides registered for the gypsy moth.

Pesticides, when used properly, can improve the quality of our lives in many ways. Their use in and around homes, gardens, offices, and other commercial establishments has brought us economic, health, and esthetic benefits. In addition, pesticides are very useful in protecting farms and forests, thereby helping in the production of food, fiber, and recreational opportunities. On the other hand, pesticides are poisons and they can adversely affect our lives if they are used indiscriminately and without care because labels are not read completely or correctly. Therefore, we must learn to READ AND FOLLOW PESTICIDE LABELS.

Every pesticide comes with instructions on how to use it. Included on the label is essential information received from a company about its product. The label serves many purposes:

—It is a legal document, approved by the U.S. Environmental Protection Agency.

—After approval, it serves as a license to sell the product.

—It provides state and federal agencies with a way to control the distribution, storage, sale, use, and disposal of a pesticide.

—It is a source of facts for the user on how the product is to be handled.

—It provides details to applicators about special-use precautions and antidotes.

Using the sample label provided on page 55, explain to the students that the following parts of the label are very important in understanding how to use the pesticide. The numbers in parentheses in front of the parts of the label listed below refer to the numbers on the sample label.

(1) TRADE NAME

Each company has a brand or trade name for its product. It is the name used in advertisements, and it shows plainly on the front panel of the label.

(2) INGREDIENTS

Every pesticide label must list what is in the product. Each active ingredient is named and given a percentage by weight. Inert ingredients may not be named, but their percentage of the contents is shown.

Many pesticides have complex chemical names for the material that is the actual active ingredient. Most have been given another name to make them easier to identify. For instance, carbaryl, one pesticide used to control the gypsy moth, is the common name for 1-Naphthyl N-methylcarbamate.

(6) PRECAUTIONARY STATEMENTS
HAZARDS TO HUMANS (& DOMESTIC ANIMALS)
DANGER

(7) ENVIRONMENTAL HAZARDS

(8) PHYSICAL OR CHEMICAL HAZARDS

(13) MISUSE STATEMENT
It is a violation of Federal law to use this product in a manner inconsistent with its labeling.

(12) STORAGE AND DISPOSAL
STORAGE

DISPOSAL

(10) RESTRICTED USE PESTICIDE
FOR RETAIL SALE TO AND APPLICATION ONLY BY CERTIFIED APPLICATORS OR PERSONS UNDER THEIR DIRECT SUPERVISION

(1) TRADE NAME

(2) ACTIVE INGREDIENT: _____ %
INERT INGREDIENTS: _____ %
TOTAL: 100.00%

THIS PRODUCT CONTAINS LBS OF PER GALLON

KEEP OUT OF REACH OF CHILDREN

(6) DANGER—POISON

(9) STATEMENT OF PRACTICAL TREATMENT
IF SWALLOWED
IF INHALED
IF ON SKIN
IF IN EYES

(4) MFG BY
TOWN, STATE
ESTABLISHMENT NO
(5) EPA REGISTRATION NO
(3) NET CONTENTS

(11) DIRECTIONS FOR USE
CROP
CROP
CROP
CROP
CROP

(3) NET CONTENTS

Tells the user how much is in the container.

(4) MANUFACTURER'S NAME, ADDRESS, AND ESTABLISHMENT NUMBER

The law requires the maker of a product to put the company's name, address, and establishment number on the label. This is to show who made or sold the product.

(5) REGISTRATION NUMBER

A registration number must appear on every pesticide label. It shows that the product has been registered with the U.S. Environmental Protection Agency.

(6) HUMAN HAZARD WARNINGS

To do their job, pesticides must control pests. By their nature, then, they must be toxic and could be hazardous. The toxicity of a product can be determined by reading signal words and symbols that appear on a label.

Signal words tell approximately how toxic a material is to people. The signal words are set by law and must be used correctly on a label.

Signal Words	Toxicity	Approximate Amount Fatal to Humans
Danger	Highly toxic	7 drops
Warning	Moderately toxic	1/6 to one ounce
Caution	Free from danger	One ounce to more than one pint

In addition to signal words, symbols are used to catch the eye. A skull and crossbones symbol is used on all highly toxic materials along with the signal word DANGER and the word POISON.

(7) ENVIRONMENTAL HAZARDS

Pesticides are useful tools. But wrong or careless use could cause undersirable effects. To help prevent this, the label contains environmental cautions to protect bees, birds, fish, wildlife, and endangered species.

(8) PHYSICAL AND CHEMICAL HAZARDS

This section tells about any special fire, explosion, or chemical hazards that a product may pose.

(9) STATEMENT OF PRACTICAL TREATMENT

The label will tell you what emergency first-aid measures should be taken if someone is poisoned.

(10) USE CLASSIFICATION

Every pesticide label must show whether the contents are for general or restricted use. General-use classification is given to pesticides that have low potential for harm to humans or the environment when used as directed. Restricted-use classification is for pesticides which could cause human injury or environmental damage. Restricted-use pesticides are only for sale to and application by certified applicators or persons under their supervision. The label will say this.

(11) DIRECTIONS FOR USE

The instructions on how to use a pesticide are very important. They tell which pests the product will control; the crops or animals it may be used on; and when, where, and how the product should be applied.

(12) STORAGE AND DISPOSAL

This section tells where and how to store and dispose of excess pesticides and/or their containers.

(13) MISUSE STATEMENT

This is a reminder that it is a violation of federal law to use a product in a manner inconsistent with its labeling. Persons guilty of not using pesticides as directed by a label could be fined for civil or criminal offenses.

All pesticides products must also bear the hazard warning **"Keep Out of Reach of Children."**

Pesticides used improperly can be injurious to human beings, animals, and plants. Follow the directions and heed all precautions on labels. Store pesticides in original containers under lock and key—out of the reach of children and animals—and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish, and wildlife. Do not apply pesticides where there is danger of drift when honey bees or other pollinating insects are visiting plants, or in ways that may contaminate water or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dusts; wear protective clothing and equipment, if specified on the label.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash skin thoroughly.

NOTE: Some states have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your local pesticide specialist, county agriculture agent, or State extension specialist to be sure the intended use is still registered.

READ THE LABEL!

STUDENT PROJECT

21

Age Class

INTRODUCTION: Pesticides are an important part of pest management programs. These programs result in better-quality food, homes, farms, and forests that we can all appreciate. But pesticides can do harm if used improperly. To reduce the problems with pesticides, our government has developed certain regulations. The agency that enforces these regulations is the U.S. Environmental Protection Agency or EPA.

Only pesticides that are EPA-approved can be sold and used in the United States. EPA must decide whether or not to approve each new pesticide.

Scientists test each new pesticide to learn many things about it. Some of the things they find out are what it will kill, what it will not kill, how long it stays poisonous after it is applied, and how hazardous it is.

Based on these tests, EPA must decide whether or not to approve each new pesticide. If a pesticide is too hazardous to man or the environment, EPA will not approve it.

If EPA approves a pesticide, it will be classified in one of two ways:

1. Restricted-Use. These can be harmful poisons. Only a specially-trained applicator who knows how to properly handle and apply pesticides can buy and use them.
2. General-Use. These are pesticides that are relatively safe to humans and the environment. Anyone can buy and use a general-use pesticide.

The use of pesticides is also controlled in other ways. For example, certain information on pesticide labels is carefully controlled. The information helps people to use them safely and correctly.

Labels must contain information in certain places. Refer to the sample label on page 55 as you read on. The numbers in parentheses in front of the parts of the label listed below refer to the numbers on the sample label.

(1) TRADE NAME

The common name of the pesticide is placed in this block. Also included here is a short statement on the pesticide's usefulness.

(2) INGREDIENTS

The chemical name of the active ingredients is included here. Active ingredients are those that are actually poisonous and are necessary to kill a pest. The other ingredients, called inert ingredients, are not poisonous and are not by themselves pesticides.

(6) HAZARD OR SIGNAL WORDS

Signal words indicate how dangerous a pesticide is to humans. If the word is "Danger," the pesticide is very toxic and only a small amount will kill a person. A pesticide labeled "Warning" is not as dangerous as one labeled "Danger." A pesticide labeled "Caution" is less dangerous than either of the other two.

(6, 7, 8) PRECAUTIONS

This section of the label lists information which will help to protect people, animals, and the environment.

(11) DIRECTIONS FOR USE

This section will tell you what pests will be controlled by the product and how it should be applied.

(12) STORAGE AND DISPOSAL

Tells you how and where to store and dispose of pesticides and their containers.

(13) MISUSE STATEMENT

This section is a reminder that pesticides can only be used according to the label. *Always* READ AND FOLLOW THE LABEL.

MATERIALS NEEDED: Pencil and paper.

INSTRUCTIONS: By yourself or as a group project, visit your local garden supply or hardware store and ask to visit their insecticide section. Insecticides are a type of pesticide used to kill insect pests.

READ THE LABEL on a variety of products on the shelf and, using your knowledge about pesticide labels, follow the outline and describe the insecticides available to control the gypsy moth. An example is completed for you on the form on the following page.

READ THE LABEL!

Trade Name	Common Name (Active Ingredient)	Signal Word	Use Classification	Precautions	Directions
Sevin 4-oil	Carbaryl	Caution	General	Harmful if inhaled or swallowed. Toxic to bees.	Apply 1 quart per acre when larvae are 1/3 grown.

TEACHER

PROJECT

22

Age Class

THE BENEFITS OF BIRDS

OBJECTIVE: To participate in a community service activity.

INSTRUCTIONS: Many species of animals eat forest-defoliating insects such as the gypsy moth. Combined, these animals constitute a predator community. This community can maintain some potentially serious pest populations at relatively harmless levels. Birds are a major component of most predator communities, and they definitely play a role in affecting population levels of the gypsy moth. At low gypsy moth densities, this role is highly significant, but as gypsy moth populations increase, the importance of predation is reduced. This is due to the inability of the millions of larvae that result when gypsy moth population densities are high.

Birds usually move into specific areas in the spring and early summer to raise their young. Often, breeding pairs will produce two broods of four to six young each. From the time of mating until the young are on their own, most birds need a diet high in protein, and insects are eaten extensively.

One method of enhancing the benefits of birds consists of providing suitable cover and nesting sites to encourage the presence of a variety of birds in areas where pest populations occur. Researchers have found that as many as 38 species of birds feed on gypsy moths. Some of these birds can be effective in maintaining sparse gypsy moth populations and therefore should be encouraged to stay in potential gypsy moth infestation areas. Birds in this group include: the black-capped chickadee, blue jay, red-eyed vireo, rufous-sided towhee, scarlet tanager, northern oriole, catbird, and robin.

Another group of birds is less effective when gypsy moth population densities are low, but they are attracted to high level populations and can help reduce pest population levels. Included in this group are the cuckoos, crow, chipping sparrow, starling, grackle, red-winged blackbird, and cowbird.

Whenever the gypsy moth is a potential problem, birds from these two groups, as well as others, should be encouraged to stay in an area. Of course, more benefit will derive from birds in the first group, but any of them can help maintain a balance of nature.

To encourage birds to remain in an area, adequate nesting facilities are essential, in addition to the ample food supply provided by the gypsy moth.

This project is designed to help you encourage students to augment natural nesting sites by providing additional cavity nests for certain birds.

For additional information on building bird houses and the usefulness of birds for controlling populations of gypsy moth, you may want to consult the following references:

Homes For Birds, Daniel Boone, U.S. Department of the Interior, Conservation Bulletin 14, Washington, D.C., 1979.

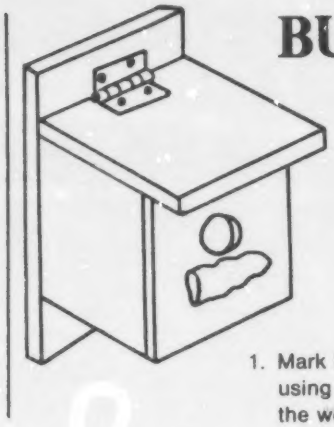
Enhancement of Wildlife Habitat on Private Lands, D. J. Decker and J. W. Kelley, Cornell Cooperative Extension Information Bulletin 181, Ithaca, NY, 1982.

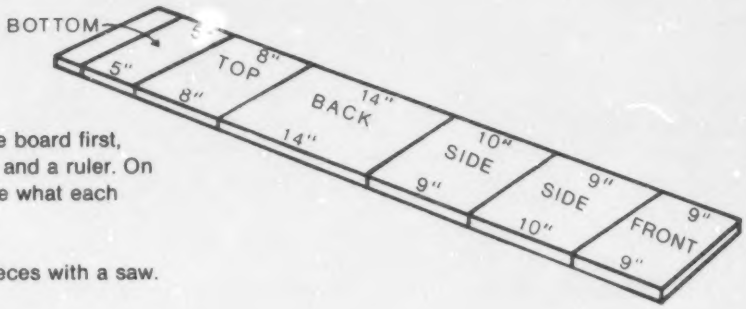
Constructing Wooden Boxes for Cavity-nesting Birds, H. L. Gary and M. J. Morris, U.S. Department of Agriculture, Forest Service, Research Note RM-381, Washington, D.C., 1980.

Predators of the Gypsy Moth, H. A. Smith and R. A. Lauterschlager, U.S. Department of Agriculture, Agriculture Handbook No. 534, Washington, D.C., 1978.

Wildlife Habitat Improvement Techniques, J. Yoakum, Wildlife Society, Inc., Washington, D.C., 1980.

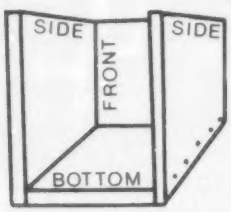
BUILDING A BIRDHOUSE





1. Mark the entire board first, using a pencil and a ruler. On the wood, write what each piece will be.

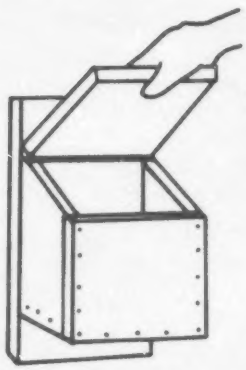
2. Cut out the pieces with a saw.



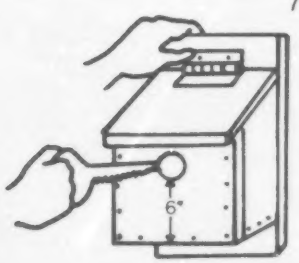
3. Nail the front to the bottom.

4. Nail on the sides. Notice that the front goes over the sides, and the bottom fits inside where you can't see it.

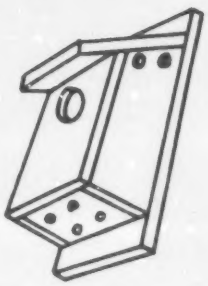
5. Nail on the back.



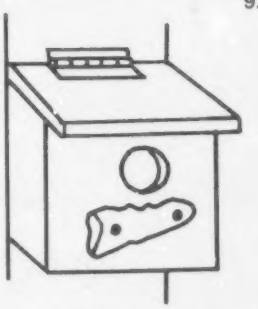
6. Put the roof on and attach the hinge. Notice that the lid is fastened only by the hinge. This will let you clean out the box when the birds are finished with it. (You can also peek inside to see the babies when the parents are away, but don't do this when they are building or have eggs, because they might not come back).



7. Cut the door hole. Make it about 6 inches above the floor and about 2 inches in diameter. The easiest way to cut this round door is with a hole-cutting attachment to a power drill (have an adult help), or you can use a keyhole saw. Drill a small hole to get it started.



8. Drill two small holes on each side just under the roof for ventilation. Drill four *small* holes in the floor for drainage in case water gets inside.



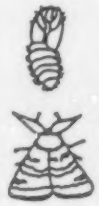
9. You can paint the *outside* only (don't paint the inside) or leave the wood natural. If you do paint, choose a color that blends with the environment. Nail a rough piece of bark just under the door hole to give the birds a firm footing.

10. Nail your birdhouse to a tree or post. A shady spot is best. Houses in the sun can heat up like an oven on a warm day. Birdhouses can also be fastened to windowsills (not beside a feeder) or under the eaves of a house.

THE BENEFITS OF BIRDS

STUDENT PROJECT 22

Age Class



INTRODUCTION: Many species of birds are known to feed on gypsy moth caterpillars and adults. Such birds are called predators, and they help to reduce the numbers of gypsy moths. Nuthatches, chickadees, towhees, vireos, northern orioles, catbirds, blue jays, and robins are all important in keeping gypsy moth populations low. Cuckoos and flocking species such as starlings, grackles, red-winged blackbirds, and crows may be attracted to areas where gypsy moth populations are already high.

It's important to encourage birds to stay in an area to help keep gypsy moth populations low. And it's something you and others in your community can do. Birds are most effective at eating large numbers of gypsy moths and their larvae when the birds have young to feed. Therefore, helping the birds with their nests is important. Robins can be encouraged to use a nesting platform placed in the branch crotch of a tree. The platform should be made of a well-weathered board at least 6 inches wide and placed where it will be shaded for part of the day. Another way to attract birds is to build a birdhouse.

MATERIALS NEEDED: A board 6 inches wide, 1/2 inch thick, and 5 feet long; a saw, hinge, pencil, ruler, hammer, nails, a drill with bits, and a keyhole saw or hole-cutting attachment for the drill.

TEACHER

PROJECT

23

Age Class

CLAY-DOUGH CRITTERS

OBJECTIVE: Identification of gypsy moth life stages.

INSTRUCTIONS: Using the descriptions provided in the introduction and additional information about the characteristics of leaf-eating caterpillars from Project Number 11, encourage students to create their own clay-dough critters.

The recipes for two kinds of clay-dough are provided on the student's page for this project. Encourage freedom of expression and creativity, and provide for a planned, learning session about the gypsy moth and the special characteristics that distinguish it from other insects.

CLAY-DOUGH CRITTERS

STUDENT PROJECT 23

Age Class

INTRODUCTION: Each kind of insect has features that make it different from all other insects. This is especially true for caterpillars and other life stages of the gypsy moth. For example, the gypsy moth caterpillar has many black hairs, five pairs of blue spots near its head, and six pairs of red spots near its tail end. With clay-dough you can create caterpillars and other life stages of your own. Here's how.

MATERIALS NEEDED: Clay-dough (see recipes), paints, plastic bag or old jar, and soap and water (for cleanup).

INSTRUCTIONS: Follow one of these recipes to make your own clay-dough. Then proceed to make your own critter creations.

RECIPES

SOFT CLAY-DOUGH

1½ cups flour
½ cup salt
½ cup water
¼ cup vegetable oil or a few drops of liquid detergent
Food coloring (optional)

DIRECTIONS: Mix flour and salt together in a bowl. Slowly add the water, oil (or detergent) and food coloring (optional). Work the dough well, and then shape into several balls. Objects created from your clay-dough will remain soft and pliable and can be reshaped later.

HARD CLAY-DOUGH

1 cup cornstarch
2 cups salt
1⅓ cups cold water

DIRECTIONS: Put salt and 2/3 cup water in a pot and boil. Combine cornstarch with remainder of water and mix well. The result will be a smooth-textured, pliable clay-dough. The objects you make with it can be air-dried and then hardened. Hardening is done by baking at 225° for two hours. Turn objects three or four times to prevent curling.

Create clay-dough critters with either soft or hard clay-dough. Try to create caterpillars and other life stages which look like those found in nature. Black bristles from an old brush, buttons or beads and paint can all be used to create a life-like representation of caterpillars like the gypsy moth.

Store unused clay-dough in plastic bags or a tight container like an old jar. If your soft clay-dough becomes sticky, add a little flour. Use your completed clay-dough critters to SHOW AND TELL your parents, friends, and neighbors.

TEACHER PROJECT

24

Age Class

WORD HUNT

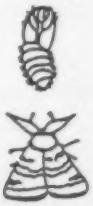
OBJECTIVE: To develop word association, recognition, and spelling skills.

INSTRUCTIONS: This project puzzle is designed to help students learn a variety of words associated with gypsy moth life stages. These words have been used in other projects in this book. A total of 27 words are hidden in the letter squares, and participants may need some assistance in finding all of them. Answers on page 78.

WORD HUNT

STUDENT PROJECT 24

Age Class



INTRODUCTION: This puzzle contains words and terms that relate to the gypsy moth, its life cycle and life history, and the natural resources around it. Also included are the names of the methods used to control the gypsy moth. Each clue describes several hidden words. There are 27 words that may be found by reading across, down, or diagonally.

MATERIALS NEEDED: Pencil.

INSTRUCTIONS: Find as many word answers as you can and circle them. Some circles will overlap.

CLUES:

Gypsy moth life stages.
Methods of control.
Other names for caterpillars.
Host names and food items.
Alternate names for gypsy moth life stages.
Other names for insects.

I R A P O S C O C O O N R V E C P I X A
B N O K I G H A P E S T I C I D E O M E
O G S O O D I K S E Q R N H T A G L E N
G M O E B I O L O G I C A L B U G S H P
I G N Y C U E A T V C N G U Y I P I R A
P E W C A T E R P I L L A R X Y Z L W R
M U V B M R X W R C H E M I C A L K O A
K G P O P E I U E M N A G X I N C T M S
F E M A L E O T D D V V Y B X S Z D H I
T H W D E S S T A O P E P F P W E O M T
K G H U O N L O T M A S S P O D T E A E
W I T L A R V A O I K D Y T E R Y S T S
L M O T H S W O R M S B E N R P E T S K
G E R H A N I P S A S W A T E Z W S O I
R E G U L A T O R Y N H G B O P E S T S

TEACHER PROJECT

25

Age Class

GYPSY MOTH SKIT

OBJECTIVE: To provide for creativity, cooperation, and a group learning experience about the balance of nature.

INSTRUCTIONS: This skit is designed to allow students to play-act and learn more about the gypsy moth and its place in nature. Encourage students to make appropriate costumes, learn their lines, and present the skit to their friends, classmates, and/or parents. There is considerable opportunity for innovation in costume design and individual as well as group expression during presentation of this skit. Other facts about the gypsy moth, included elsewhere in this workbook, can be incorporated into this skit.

To provide props for your students' skit, you may want to encourage them to make balloon caterpillars by blowing up balloons and tying off the ends. They can decorate the balloons with paint, glue, and paper to look like gypsy moth caterpillars. Remind students that gypsy moth caterpillars have five pairs of blue spots on their backs, followed by six pairs of red spots. They also have bristly, black hairs. Can your students think of a way to add these hairs to their balloon caterpillars?

GYPSY MOTH SKIT

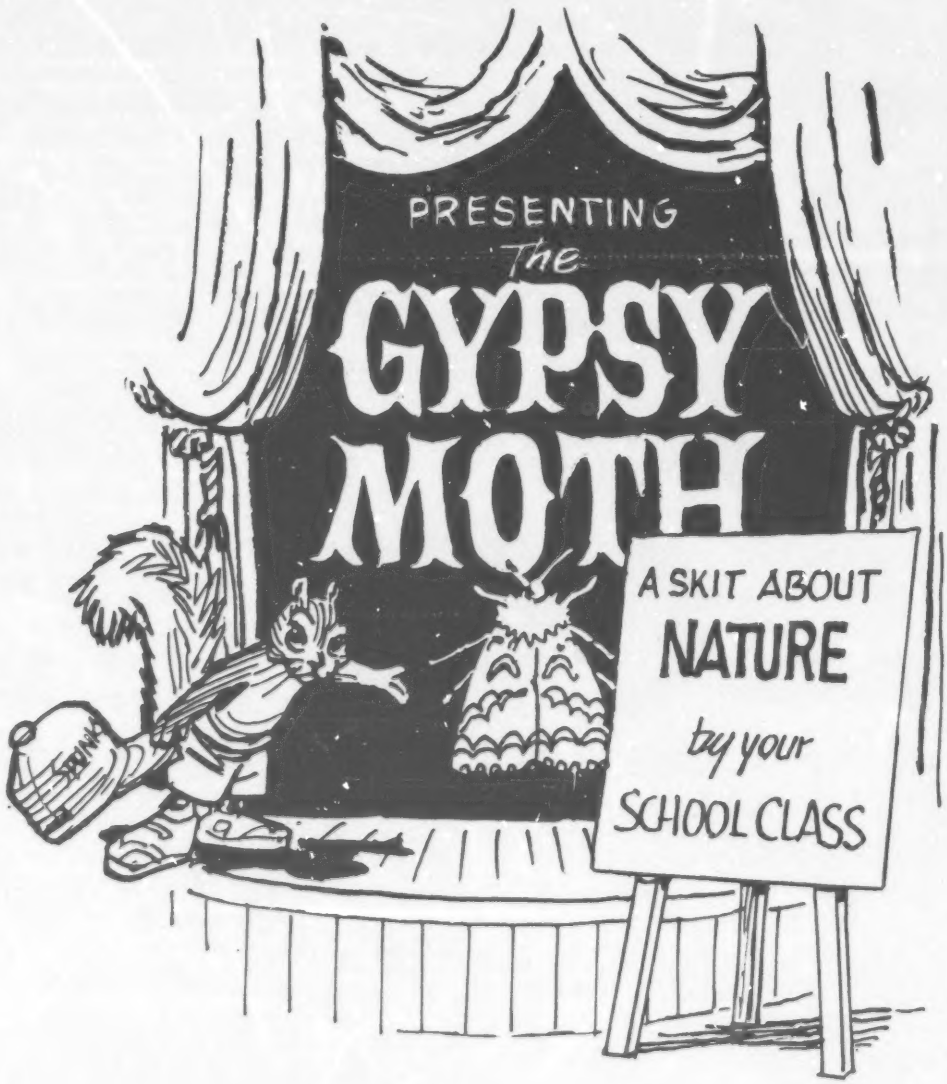
STUDENT PROJECT 25

Age Class

INTRODUCTION: This skit is designed to help you learn more about the gypsy moth by play-acting. You and your friends can select actors, design costumes, and present the skit however you wish. Depending on what you want, this skit can be very simple or very complex.

MATERIALS NEEDED: Self-designed costumes and props.

INSTRUCTIONS: Select friends or classmates to play the parts. Learn your lines, make your costumes, and present the skit.



GYPSY MOTH SKIT

NARRATOR: It is a bright summer morning and the sun is climbing into the sky from behind its blanket of dark green hills. The forest is coming alive. Birds and other animals are waking to greet a fine new day. Let's watch and see what's happening. Over there in a big pine tree, two blue jays are having an argument. Let's listen in.

MRS. JAY: Wake up, Mr. Jay. It's time to get busy.

MR. JAY: Busy? Busy doing what?

MRS. JAY: Busy building our nest.

MR. JAY: Oh, I thought you meant something more important.

MRS. JAY: More important! What's more important than building a home for our children? Now go on. (PUSHES MR. JAY OUT OF NEST.) Shake your lazy legs and get busy.

MR. JAY: (LOOKS BACK AND SHAKES HIS HEAD.) Sometimes I wish you weren't such an early bird.

MRS. JAY: Jay!

MR. JAY: Sorry, I'm going, but first I'm going to get some breakfast. (MR. JAY LEAVES AND MRS. JAY HOPS ABOUT GATHERING TWIGS FOR THEIR UNFINISHED NEST.)

(MALE DEER ENTERS CAUTIOUSLY, WALKING SLOWLY AND MOVING HIS ANTLERS FROM SIDE TO SIDE. OCCASIONALLY, HE PUTS HIS HEAD DOWN AND TAKES A BITE OF GRASS.)

MALE DEER: What a morning! (LOOKS ALL AROUND.) Not a cloud in the sky. What a day for grazing! (WALKS OVER TO POOL OF WATER, WHERE HE IS JOINED BY A FEMALE DEER.)

(TWO RABBITS HOP ON STAGE, WIGGLING THEIR NOSES AND FLAPPING THEIR EARS. THEY STOP TO NIBBLE GRASS, THEN JUMP AND HOP OFF STAGE.)

MALE DEER: I think we've used up most of the food here in this pine forest. Let's go look in another place.

FEMALE DEER: O.K. How about that place where the hardwoods, like oak and maple, grow so big?

MALE DEER: Yes, I know that place. The leaves are gone, and there's more light for grass to grow.

MR. HAWK: (COMES IN WORRIED AND UPSET.) Screee! Screee! Wake up, you lazy wood folk. Gather round and listen to what I have to say. (ALL ANIMALS EXCEPT DEER GATHER AROUND.) There is danger in the forest, the kind we've come to dread.

MRS. JAY: (HOPS DOWN AND COMES CLOSE TO MR. HAWK.) We *are* awake, Mr. Hawk. What are you so excited about?

MR. HAWK: It's really quite alarming, and I'm in such a state. I'm so upset. We must do something before it's too late.

SQUIRREL: Calm yourself and tell us what you're talking about.

MR. HAWK: They're here again!

RABBIT ONE: Who is here?

MR. HAWK: Those awful worms. I mean those caterpillars. The ones that came last year and ate all the leaves.

RABBIT TWO: You mean there are gypsy moth caterpillars in the forest again?

MR. HAWK: Yes, yes! Ohhh, what shall we do?

MR. JAY: We must think of something. They make such a mess of our beautiful forest.

MRS. JAY: Let's shake all the trees to try to frighten them away.

MR. HAWK: Don't be silly—that won't work. We need help.

SQUIRREL: I know. Let's get Wise Old Owl. He'll know what to do.

MR. HAWK: You're right. I should have done that right away.

MR. JAY: Yes, we better get some advice before it's too late.

MRS. JAY: Hurry, Jay, go get Wise Owl. Hurry, Hurry, Hurry! (SHE PUSHES HIM ACROSS THE STAGE.)

MR. JAY: I'm going, I'm going.

(MR. JAY GOES OFF STAGE LEFT, AND THE ANIMALS HIDE AS THE SOUNDS OF MUNCHING CATERPILLARS CAN BE HEARD OFF STAGE RIGHT.)

NARRATOR: Just as Mr. Hawk said, there are gypsy moth caterpillars in the forest, and here they come.

(FIVE APPROPRIATELY COLORED GYPSY MOTH CATERPILLARS COME INCHING THEIR WAY ON STAGE, MUNCHING AND CRUNCHING TASTY LEAVES. BALLOON CATERPILLARS CAN BE PLACED ON THE STAGE NOW.)

LEAD CATERPILLAR: This looks like a good place to eat.

CATERPILLAR 2: Yes, there are some of our favorite trees here.

CATERPILLAR 3: Right. Oak, alder, apple, birch, and willow. Boy, am I hungry!

CATERPILLAR 4: So am I. Let's climb these trees, and maybe a breeze will come up to swing us along.

LEAD CATERPILLAR: Right, we'll eat all these leaves, spin a silken thread, and then, like Tarzan, let the wind carry us to new trees. (LEAD CATERPILLAR CLIMBS, PRETENDS TO SWING ACROSS STAGE.) Wheee!

CATERPILLAR 2: I sure hope I never land on ash, sycamore, locust, or dogwood because I don't like those trees.

CATERPILLAR 3: We also don't want to be caught in the open because we could be eaten by shrews, birds, or beetles.

CATERPILLAR 4: Eeh! I don't want that to happen to me! For awhile, I'm only going to eat at night and hide during the day. (CALLING BACK TO THE OTHERS.) Come on, gang.

LEAD CATERPILLAR: When we all get bigger, we can eat night and day.

CATERPILLAR 2: Yeah, then we'll be fat and sassy and take a nap.

CATERPILLAR 3: Then before you know it, we'll be adult moths and that's when the real fun begins!

CATERPILLAR 4: Fun for you, maybe! As an adult male you get to fly around and try to find me. All we females get to do is sit and wait!

CATERPILLAR 5: Aw, posh! You'll have fun, too. Your scent and black and white beauty will have many a male moth zigzagging to your spot.

LEAD CATERPILLAR: Well, enough of your day-dreaming about the near future—let's get on with eating the forest.

(LEAD CATERPILLAR AND GANG EXIT LEFT, INCHING AND MUNCHING ALONG.)

NARRATOR: As we and the animals of the forest have seen, gypsy moth caterpillars can eat a lot of leaves. Let's listen again.

(MR. JAY ENTERS RIGHT WITH WISE OWL IN TOW.)

MR. JAY: See, Wise Owl, this is what they've done to our forest. They've eaten all the leaves and made a mess on the forest floor.

(ALL OTHER ANIMALS BEGIN TO CREEP OUT AND SEE WHAT THE CATERPILLARS DID AND WHAT WISE OWL HAS TO SAY.)

MR. JAY: What's your advice?

WISE OWL: Well, you see, it's true that the gypsy moth caterpillars did eat a lot of leaves, but most of the trees are healthy and their leaves will come out again. Those that had their leaves eaten before might die, but that may provide homes for some of us. So let me hear from some of you. Squirrel?

SQUIRREL: Ahhhh, I'm so full, I ate so many caterpillars I could just burst.

WISE OWL: Mr. and Mrs. Jay?

MRS. JAY: (CHATTERING EXCITEDLY.) We're so happy. We've had our largest family ever, due to so much food this year!

WISE OWL: And let's hear from the deer?

MALE DEER: (PROUDLY.) Yes, we too had lots of grass to eat this year, and our little fawn is as fit as a fiddle.

WISE OWL: Well, now you see that even though you thought the gypsy moth caterpillars were a serious threat to the forest, you're finding out something a bit different. I've asked my forest ranger friend to explain a bit more.

(RANGER ENTERS STAGE AND, WITH BACK TO AUDIENCE, BEGINS TO EXPLAIN TO THE FOREST ANIMALS. NODDING AND DISCUSSING WITH EACH ANIMAL IN SUCCESSION AND THE GROUP AS A WHOLE.)

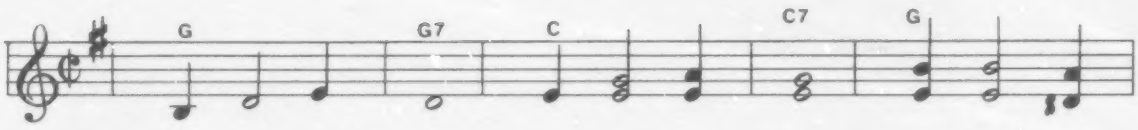
RANGER: You see, Wise Owl is right. The gypsy moth that was accidentally released into our forest many years ago is now a naturalized citizen. Just like some of you. We needn't become hysterical about them, but we do need to understand their role in the forest. To some, their presence means an ample supply of food; to others it means less. To men, like me, it means we have to determine the good and the bad and make decisions about controlling the gypsy moth for the benefit of animals and people who like to have and use green trees. All in all, gypsy moths have to be considered as a part of Mother Nature's plan in her balance of nature.

WITH RANGER LEADING THE CAST, THEY SING THE INCH-ALONG SONG ON THE NEXT PAGE. IT IS SUGGESTED THAT THE SONG LYRICS BE GIVEN TO THE AUDIENCE SO IT CAN SING ALONG.

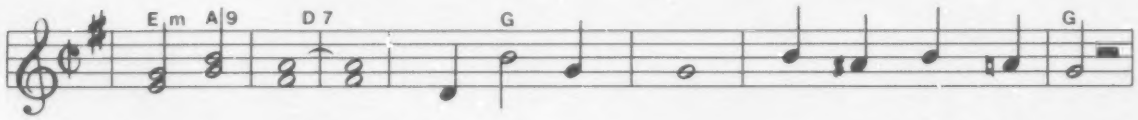
INCH ALONG SONG

Slowly with a beat

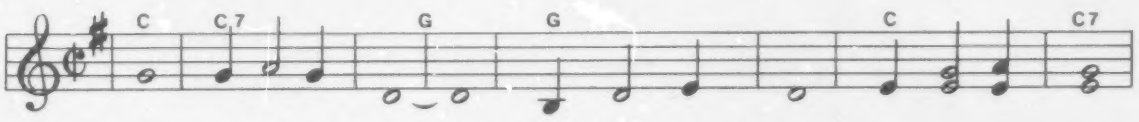
Words by Dennis Hamel **Music by Dave Alligood**

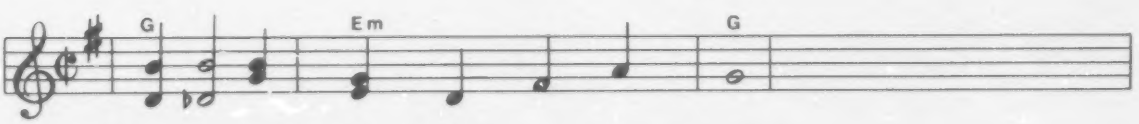


1. In- ching a - long, in-ching a - long, in-ching a-
2. Feed - ing by night, sleep - ing by day, grow - ing by
3. Mov - ing from East, go - ing to West, eat - ing a-



long all day. Our lips will sing, when we find that tree,
leaps and bounds. Our skins we'll shed, when we eat e-nough,
long the way. Men try to stop, as we inch our way,

high, migh-ty and green. Leaves of oak, with lobes of three,
leaves, ti-ny or big. Worms we are, a moth we'll be,
from sea to the sea. Man must learn, to live with us,

sweet, jui-cy, and green. CHORUS:
fat, happy, and free. In-ching a - long, in-ching a-long,
we're part of the scene.



in-ching a- long. just you and me.

APPENDIX A

ANSWERS

PROJECT 4

QUIZ BOX

O	A	K
A	P	E
K	E	Y
B	E	E
E	G	G
E	G	O
B	U	G
U	T	E
G	E	M
L	A	W
A	P	E
W	E	B
A	I	R
I	R	E
R	E	D
F	L	Y
L	E	E
Y	E	W

PROJECT 5

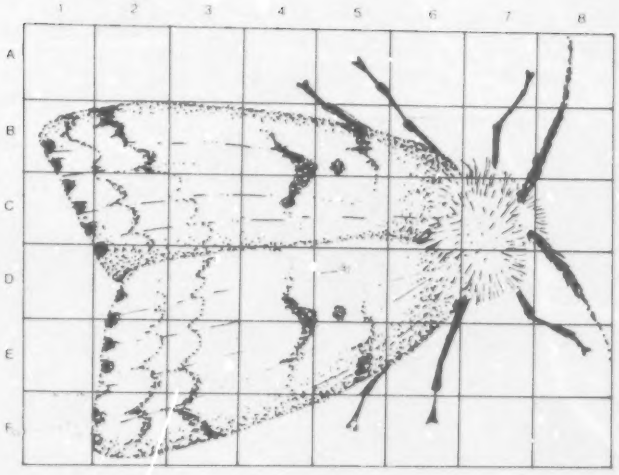
WORD RING

YOUR WORD LIST

LARVA	EDGE
AD	GEM
ADULT	EMIT
TWO	MITE
WORM	MIT
OR	ITEM
MOTH	IT
MOTHER	ME
HE	MEN
THE	MEND
OTHER	END
THERE	DOLL
HER	DO
HERE	DOLLAR
ERE	RE
RED	EM

PROJECT 6

PICTURE THIS



PROJECT 7

SPIRAL SPELLING

PROJECT 8

WORD PYRAMID

1	I								
2	I	N							
3	T	I	N						
4	T	I	N	E					
5	S	T	E	I	N				
6	I	N	S	E	C	T			
7	N	O	T	I	C	E	S		
8	S	E	C	T	I	O	N	S	
9	C	E	S	S	A	T	I	O	N
10	A	C	T	I	O	N	L	E	S	S

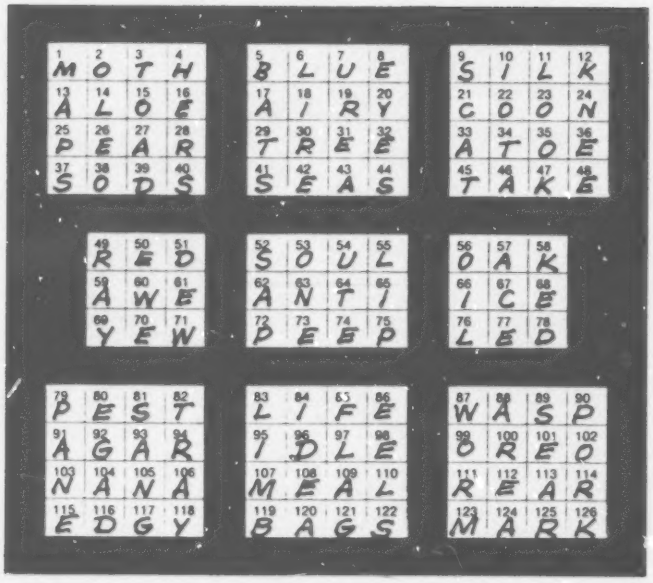
APPENDIX A

ANSWERS

(continued)

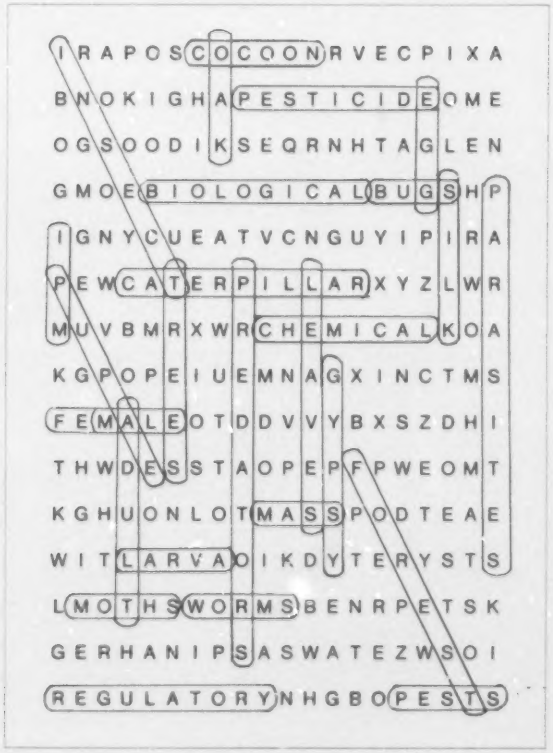
PROJECT 19

CROSSWORD QUIZ



PROJECT 24

WORD HUNT


I R A P O S C O C O O N R V E C P I X A
B N O K I G H A P E S T I C I D E O M E
O G S O O D I K S E Q R N H T A G L E N
G M O E B I O L O G I C A L B U G S H P
I G N Y C U E A T V C N G U Y I P I R A
P E W C A T E R P I L L A R X Y Z L W R
M U V B M R X W R C H E M I C A L K O A
K G P O P E I U E M N A G X I N C T M S
F E M A L E O T D D V V Y B X S Z D H I
T H W D E S S T A O P E P F P W E O M T
K G H U O N L O T M A S S P O D T E A E
W I T L A R V A O I K D Y T E R Y S T S
L M O T H S W O R M S B E N R P E T S K
G E R H A N I P S A S W A T E Z W S O I
R E G U L A T O R Y N H G B O P E S T S

PROJECT 20

PESTICIDES AND ALTERNATIVES

The seven potential problems with chemical pesticides are hidden in the letters below. They may read left to right or top to bottom. Can you find them?

A C D R Y T B H R C F N K R R F M S
F E W A C B I L P A E N G J E O P R
E W Q S K O L U N C Z O U R S E S D
F S K I C O N T A M I N A T I O N P
R G J I L O P T B J R T E W S C N O
E F H K M B V S E T V A C E T W T B
H D M I L E B J L A S R J T A B E R
R G K L E W Q A Z X N G K O N P Y R
E T H K U I R E W Q A E L R C T E Z
S E C O N D A R Y O U T B R E A K S
U R Y J K L U T R E W O A X C V G T
R E G J K O U Y T R C R A Q W E R I
G T J N V D W X C V B G N M L I G H
E F U Z C D E W J K G A D S A C V B
N J K L D E R T Y U B N C B N M E W
C S M P I O Y H T R E I C V B J U I
E N E R G Y C R I S I S V X U I Z W
W F T Y U I N M K I G M I S U S E P
A W Q X V U O P M J U S H T R V E C

The six major tactics available for use in an IPM program for the gypsy moth are hidden in the letters below. They may be read from left to right or top to bottom. Can you find them?

D J K C U Y T B H R C F G K R F M S
F R P E K E H W X A U A D I S C B Y
E D S W U W B J V W L Q E P T B J K
F P N E Y Q E K Q X T W R O E S L L
R O N S T S W G W H U E T Y L T M U
E B T R B K V Z F T R R Y R Z J B M
H R O P H O B D T R A I U T X N I W
R M E C H A N I C A L S B W N V O T
E S O Y R L Q E H V M J A A O D L B
L T Y E C U R R E U E A C C P W O P
U I T N F C Y Y M A N U A L E X G Y
L H A T G Z J U I M W E C B J C I R
A B W V K L K B C T D M D I K V C E
T W Q I R R U O A I S T R R O B A S
O T I O F S T P L Q A Y T P U F L D
R M X A M D R J Y C C X Y N Y U S F
Y A V B S E E U S B V W B B T Z R M
W N M S O F B S M N B V M A R C T S
Z X Y P M Q S V X R A M Z Q V W C E

APPENDIX B

GLOSSARY

Active ingredient—	part of a pesticide that acts on or controls a pest.
Alternatives—	choices of possible actions that may be taken.
Antennae—	paired sense organs on an insect's head, also called feelers.
Arthropod—	animal with a hard skin, jointed legs, and no backbone.
Attractant—	a substance capable of attracting.
Biological—	one method of controlling pests without the use of chemicals, such as encouraging the population growth of parasites and predators.
Burlap—	loosely woven cloth of flax or hemp.
Caterpillar—	wormlike stage of moth or butterfly.
Chronology—	sequence of events.
Conventional chemicals—	traditional pesticides made from chemicals.
Defoliator—	a leaf-eating caterpillar.
Disparlure—	the laboratory-produced scent of the female gypsy moth.
Ecology—	the science of relationships between animals and their environment.
Egg mass—	a clump of insect eggs, usually covered by froth or hairs.
Entomology—	the study of insects.
Eradicate—	to totally remove or kill.
General use—	a class of pesticides that can be used by the general public.
Hardwood—	leaf-losing trees like oak.
Host—	an insect's food source (such as a tree) or nourishment for a parasite or predator.
Insect—	a six-legged arthropod.
Insecticide—	a pesticide used to control insects.
Instar—	a stage between larval molts.
Integrated Pest Management—	a decisionmaking process that considers all available chemical, biological, cultural, regulatory, mechanical, and manual tactics.
Larva—	a wormlike caterpillar.
Life cycle—	progression through the stages of life.
Life history—	the life cycle and habits of an animal or insect.

GLOSSARY

(continued)

Molt—	a shedding of the skin.
Pathogen—	an organism, such as a bacterium or virus, that can cause a disease.
Para-dichlorobenzene—	mothballs.
Parasite—	an organism living in or on another organism.
Pest—	a plant or animal competing with humans.
Pesticide—	a material used to control a pest.
Pheromone—	the scent of an insect.
Predator—	an animal that feeds on other animals.
Primary legs—	jointed walking legs of larvae.
Pro-legs—	fleshy, nonjointed legs of larvae.
Pupa—	an insect resting stage between larval and adult stages.
Riker Mount—	a glass-covered, cotton-lined display box.
Resistant—	non-susceptible to a pesticide.

American Forestry Association

USDA Forest Service